# Improving Supply Chain Transparency with Digital Exchange of Traceability and ESG (Environmental, Social and Governance) Credentials to Facilitate APEC Trade Flows

APEC Committee on Trade and Investment

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**May 2026**

APEC Project: CTI 207 2023A

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## EXECUTIVE SUMMARY

This final report presents the outcomes of the APEC CTI 207 2023A project, *"Improving Supply Chain Transparency with Digital Exchange of Traceability and ESG Credentials to Facilitate APEC Trade Flows"*, led by Peru under the Committee on Trade and Investment (CTI). The project aimed to strengthen the digital capabilities of supply chains—particularly for Micro, Small and Medium Enterprises (MSMEs)—through the adoption of Global Data Standards (GDS) and the integration of traceability and Environmental, Social and Governance (ESG) credentials.

This report includes the APEC Framework on Supply Chain Transparency, developed collaboratively across participating economies. A key outcome is the development of a practical and replicable Roadmap (Action Plan) to guide APEC economies in the implementation of traceability and ESG systems using interoperable, standards-based digital solutions. The Framework and Roadmap are expected to serve as strategic tools for scaling and replicating the project's methodology, with a particular emphasis on MSMEs inclusion and empowerment.

To validate the methodology, pilot projects were conducted in three economies - People's Republic of China; Indonesia and Peru - featuring diverse industries such as textiles, coffee, wood, silk and palm sugar. These pilots were designed to test real-life application of traceability platforms, GDS identifiers with 2D codes and ESG credential integration in MSMEs contexts. The report highlights three MSMEs case studies and documents four best practices demonstrating how digital transformation can improve supply chain transparency, regulatory compliance, and access to international markets. A virtual validation meeting with representatives from five APEC economies was held to present and receive feedback on the findings, framework and roadmap.

The final section presents a comprehensive list of recommendations to support the continued adoption of global standards, promote interoperability between public and private systems, enhance ESG credibility and enable cross-border trade facilitation through digital transparency.

The project has successfully delivered on the objectives endorsed by the Committee on Trade and Investment (CTI), the Sub-Committee on Standards and Conformance (SCSC) and the Digital Economy Steering Group (DESG). Through the design and execution of pilot projects in three APEC economies, the development of a standardized framework and the provision of capacity-building activities, the project has demonstrated how digital exchange of traceability and ESG credentials can facilitate trade, improve transparency and strengthen risk management across supply chains. It has provided concrete benefits for MSMEs, enhanced regional knowledge and capacity, and contributed to the Putrajaya Vision 2040 by advancing innovation, digitalization and sustainable, resilient and interconnected supply chains within APEC region.

We hope this document serves as a foundational reference to initiate the widespread adoption of traceability and ESG credential systems across APEC economies, with a special focus on supporting MSMEs. As global demands for sustainability and transparency continue to grow, this Framework and Roadmap aim to equip APEC enterprises—particularly smaller actors in the supply chain—with the tools and standards needed to enhance their competitiveness, ensure regulatory compliance and facilitate seamless trade flows across the region.

# 1. INTRODUCTION

This Final Report of the APEC Project CTI 207 2023A – Improving Supply Chain Transparency with Digital Exchange of Traceability and ESG (Environmental, Social and Governance) Credentials to Facilitate APEC Trade Flows – consolidates the achievements and findings of the two previous phases of the project and presents the final deliverables aimed at facilitating the broader adoption of digital traceability and ESG credential systems across APEC economies, with a special focus on MSMEs.

The first midterm report focused on a global review of the most widely used methodologies and frameworks for implementing supply chain traceability and ESG credentials. It also examined existing Global Data Standards (GDS) and evaluated their applicability for scalable implementation by MSMEs. Based on this research and benchmarking effort, a four-step methodology and a set of Global Data Standards requirements were designed to guide the second phase of the project.

The second midterm report documented the practical application and validation of this methodology through pilot projects implemented across six supply chains in People's Republic of China; Indonesia and Peru. These pilots, which included items such as silk, down coats, coffee, palm sugar and wood, were selected by each economy based on products prioritized at the governmental and local level and demonstrated the feasibility, adaptability and scalability of the designed approach. Although the considerations that guided the selection of products for each economy have already been mentioned above, the specific and detailed reasons that led to their selection are presented below. Through technical support, training and close collaboration with MSMEs, the pilots verified that the proposed methodology and selected Global Data Standards could be effectively applied in diverse operational environments, strengthening transparency, interoperability and sustainability in the participating supply chains.

- **People's Republic of China - Criteria for the selection of products and participating MSMEs in the Pilots**
  For this pilot program, People's Republic of China has selected the silk and down textile supply chains primarily for two key reasons. First, the textile industry is one of People's Republic of China's traditional competitive sectors. Second, in-depth research indicates that textile enterprises are growing increasingly concerned about upcoming ESG regulations and have taken the initiative to seek solutions and advisory support. Against this backdrop, these two textile supply chains were chosen for their distinct strengths rooted in Chinese tradition: silk, a globally recognized traditional Chinese product, has a long history and a supply chain that spans multiple provinces; down, meanwhile, leverages People's Republic of China's position as the world's largest down manufacturing economy supported by a unique and mature supply chain. This pilot's selection of these MSMEs aims to directly address their core challenges in complying with global trade digitalization and sustainability regulations.

- **Indonesia - Criteria for the selection of products and participating MSMEs in the Pilots**
  The participating MSMEs were selected based on a combination of strategic and technical criteria. Two MSMEs were involved in this pilot, specializing in coffee and palm sugar products. Strategic considerations included alignment with local economic priorities, market potential, and contribution to the development of high-demand sectors, ensuring that the selected MSMEs could deliver meaningful impact. Technical criteria focused on the readiness of the MSMEs to adopt digital solutions, existing production capacity, quality standards compliance, and ability to integrate new technologies into their operations.

  In addition, the selection process was guided by input and recommendations from relevant government ministries, including the Ministry of Trade through CTI-Indonesia and the Ministry of Agriculture. These inputs helped ensure that the chosen MSMEs were not only aligned with policy objectives but also positioned to maximize the impact and scalability of the pilot.

Furthermore, MSMEs demonstrating willingness to actively participate in pilot activities and engage in continuous learning were prioritized to ensure successful outcomes and sustainable implementation

- **Peru - Criteria for the selection of products and participating MSMEs in the Pilots**
  The selection of the two supply chains in Peru was primarily based on a local prioritization process, reflecting the government's strong concern over the impact of the European Union Deforestation Regulation (EUDR – Regulation (EU) 2023/1115) on exports, particularly to Europe. At that time, several public and private organizations were actively engaged in preparing companies for compliance, with a specific focus on MSMEs. Consultations with institutions such as Ministry of Foreign Trade and Tourism (MINCETUR), the Ministry of Agriculture and SERFOR (National Forest and Wildlife Service), among others, confirmed the prioritization of coffee and wood as the most relevant supply chains. Within coffee, Norandino, despite being a cooperative that brings together multiple small-scale producers, was chosen for its productivity, organizational maturity and openness to international collaboration. In the case of wood, the final selection of Catahua was driven by its scale, which better reflects the challenges faced by smaller enterprises in adapting to global sustainability requirements. Through this approach, the Peruvian pilots ensured alignment with regulatory and market priorities while showcasing the adaptability of the proposed methodology in high-demand, export-oriented sectors.

This final phase builds on those validated results to deliver key strategic outputs designed to support broader implementation across APEC economies. These include:

- A practical **Framework** that integrates traceability and ESG data management using GDS,
- An **Implementation Roadmap** for economies and companies to progressively adopt the approach,
- A set of **Best Practices** derived from the pilots,
- The development of **three Case Studies** showcasing the application of the methodology in specific MSMEs-led supply chains and
- **Recommendations** to support policymakers, industry stakeholders and MSMEs in achieving more transparent, sustainable and inclusive supply chains.

The content presented in this report reflects both the strategic vision and the technical detail necessary to ensure that other companies—particularly MSMEs—across the APEC economies can replicate and scale these practices, aligned with global trade and sustainability standards.

## 2. BACKGROUND

This section provides an overview of the two phases that laid the foundation for the APEC Project CTI 207 2023A – Improving Supply Chain Transparency with digital exchange of traceability and ESG (Environmental, Social and Governance) credentials to facilitate APEC trade flows. It gives a summary of the main technical and operational milestones achieved during the research, design and pilot implementation phases, offering the context to understand the evolution of the project, from the development of a standardized methodology and selection of Global Data Standards (GDS) to the validation of these tools through pilot projects in three APEC economies. The findings and insights from both phases inform the final framework, roadmap, best practices, case studies and recommendations presented in this document.

### 2.1. Research and design of standardized processes, using global data standards for digital exchange of traceability and environmental, social and governance (ESG) credentials.

Phase 1 of the project focused on the research and design of a standardized methodological framework to support the digital exchange of traceability and ESG credentials across supply chains. The objective of this phase was to identify internationally recognized methodologies and data standards capable of enabling interoperable, scalable and cost-effective information exchange, with consideration for the adoption capacity of micro, small and medium-sized enterprises (MSMEs) across APEC economies.

To support this objective, the project team conducted a structured global benchmarking exercise reviewing internationally recognized data standards, methodologies and reporting frameworks related to supply chain traceability, digital data exchange and sustainability reporting. The research reviewed multiple frameworks developed by independent global organizations, including ISO traceability standards as well as several ESG-related frameworks such as the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), International Labor Organization (ILO) frameworks and other relevant initiatives.

The benchmarking process was designed to ensure a neutral and evidence-based assessment of available international standards. The evaluation applied transparent criteria, including:

- Global adoption and presence
- Adoption across APEC economies
- Use in non-APEC economies
- Adoption by governments as well as the private sector
- Ease of implementation and accessibility for MSMEs

These criteria were applied to assess the relative suitability of the different standards and frameworks for enabling interoperable traceability systems and supporting the digital exchange of ESG-related information within supply chains.

Based on this comparative analysis, the project identified a combination of complementary standards that together provide a practical and scalable approach for the pilot implementations. The recommended framework integrates ISO-aligned traceability methodologies, GRI and SASB sustainability frameworks for ESG indicators and GS1 Global Data Standards (GDS) for product identification, location identification and interoperable event-based data exchange.

Within this framework, globally recognized identification standards such as the Global Trade Item Number (GTIN) and the Global Location Number (GLN) enable consistent identification of products, organizations and locations across supply chain actors. These identifiers can be combined with Electronic Product Code Information Services (EPCIS) to capture and share event-based traceability data across multiple information systems while maintaining interoperability between different platforms and stakeholders. In addition, the use of 2D codes with Digital Link technology enables a single code to connect physical products to digital information sources, facilitating access to extended product information, including

sustainability-related data and ESG credentials, through standard web technologies accessible from mobile devices.

The final recommendation reflects the outcome of this comparative evaluation, which identified the combination of ISO-aligned traceability methodologies, GRI/SASB ESG frameworks and GS1 data standards as the most interoperable and scalable option for the pilot implementation context.

This selection reflects the outcome of the benchmarking process and does not exclude the existence or use of other standards in different sectors, jurisdictions or implementation contexts.

Following the benchmarking and standards selection process, the project team designed a simplified and modular implementation methodology structured around four main stages:

(1) Mapping the supply chain and identifying key traceability and ESG requirements,
(2) Selecting and applying appropriate global data standards,
(3) Designing interoperable digital data exchange processes using open standards such as EPCIS and Digital Link and
(4) Validating the framework through pilot implementations with participating supply chain actors.

This modular structure enables progressive adoption depending on the digital maturity and regulatory context of each economy and was specifically designed to facilitate implementation by MSMEs. During the pilot phase, the methodology proved adaptable to companies with varying levels of digital readiness. Even enterprises initially relying on manual or partially digital processes were able to adopt traceability and ESG credential practices when supported with appropriate tools, capacity building and technical guidance.

By integrating ESG indicators within the traceability framework, the methodology also enables the digital exchange of sustainability-related information across supply chain actors. This approach contributes to improved supply chain transparency, facilitates responsible sourcing practices and supports MSMEs in meeting emerging sustainability and traceability requirements in international markets.

The complete details, including the global benchmarking of methodologies and global data standards that served as the basis for the selection and recommendations of this project phase, can be consulted in the following APEC report: *"Midterm Report Milestone 1 – Research and Design of Standardized Processes, Using Global Data Standards for Digital Exchange of Traceability and Environmental, Social, and Governance (ESG) Credentials."*

For further clarification and to facilitate the reader's understanding of the benchmarking process referenced in this section, the comparative tables that formed part of the global benchmark are also included in *Annex 9.1. Research results on Traceability and ESG credential methodologies and Global Data Standards*.

## 2.2. Research report on outcomes of traceability and ESG credentials pilots

Phase 2 presented the execution results of six pilot projects conducted in three APEC economies: People's Republic of China; Indonesia and Peru. These pilots aimed to validate the use of Global Data Standards (GDS), specifically GS1 standards and 2D Digital Link, to enable traceability and ESG data capture and visibility, particularly for MSMEs.
Each economy selected two representative value chains of export significance and MSMEs involvement. People's Republic of China selected silk and down coats, Indonesia chose coffee and palm sugar, and Peru worked with coffee and wood. The pilots were conducted in two stages: the first for field data collection and mapping of current traceability processes and the

second for implementation of Global Data Standards (GDS)-based traceability and ESG data capture tools. Key activities included stakeholder training, deployment of mobile apps and cloud platforms to support MSMEs, development of traceability records, ESG credential recording and testing of 2D code application on export and retail packaging.

Notably, in Peru, 2D codes were successfully printed directly onto jute coffee bags using screen printing (serigraphy). Despite the rustic nature of this method, the resulting 2D codes were fully scannable with standard mobile phone cameras, demonstrating the feasibility of using low-cost, locally available printing solutions. In contrast, in Indonesia, the same 2D code was applied to coffee packaging designed for retail sale, which typically involves more standardized printing processes. This comparison highlights the adaptability and versatility of 2D Digital Link codes across different production environments and levels of technological sophistication and contexts.

The main findings show that MSMEs can effectively adopt digital traceability solutions when supported with training and simple, interoperable platforms. The pilots proved that even in limited infrastructure settings, MSMEs could collect, digitize and share product lifecycle and ESG data. The use of 2D codes proved effective in bridging B2B and B2C transparency, allowing consumers and supply chain partners to access extended product data with a single & simple scan.

Challenges included variations in digital maturity, need for alignment on ESG metrics and capacity-building gaps. However, the pilots also demonstrated significant benefits in terms of supply chain visibility, quality assurance, consumer confidence and market access.

These findings directly informed the development of a scalable Framework and Roadmap for broader APEC implementation, supporting the digitalization of trade flows and enabling sustainable, inclusive trade practices in the region.

The complete details of this project phase can be consulted in the following APEC report: "*Midterm Report Milestone 2 - Research Report on Outcomes of Traceability and ESG credentials Pilots".*

# 3. FRAMEWORK FOR TRACEABILITY REGISTRIES AND ESG CREDENTIALS

## 3.1. Purpose and Scope

In the context of this report, a *framework* refers to a high-level structured set of guiding principles, foundational components and methodological steps that provide a conceptual and operational foundation for implementing digital exchange of traceability records, ESG (Environmental, Social, and Governance) credentials using Global Data Standards (GDS).

This framework is intended to serve as a reference model for APEC economies aiming to enhance supply chain transparency, product integrity and ESG data integration. It is particularly focused on enabling Micro, Small and Medium Enterprises (MSMEs) to adopt traceability solutions in a practical and scalable manner, aligned with global standards. The framework is applicable across various sectors — including agriculture, food, textile and forestry — and is adaptable to economies at different stages of digital maturity. By leveraging open and interoperable Global Data Standards (GDS) tools such as GTIN, GLN, EPCIS and 2D Digital Link, the framework supports both public and private stakeholders in advancing inclusive, efficient and sustainable trade practices across the APEC economies.

## 3.2. Framework

### 3.2.1. Importance of supply chain transparency in APEC, particularly for MSMEs

Supply chain transparency has become a critical enabler of inclusive, resilient and sustainable trade in APEC economies. In an increasingly complex global trade environment, transparency supports trust among stakeholders, improves product integrity and facilitates compliance with global standards. For micro, small and medium-sized enterprises (MSMEs), which make up over 97% of businesses across APEC economies[1], access to transparent and interoperable supply chains is essential for market access and competitiveness. As highlighted in the APEC SCFAP III Mid-term Review (2024)[2] and the APEC Policy Support Unit Report on Helping Businesses Build and Maintain Open, Secure and Resilient Supply Chains (2024)[3], digital transformation and traceability tools are no longer optional but necessary for reducing transaction costs, improving visibility and ensuring business continuity—especially in times of disruption.

Despite their economic importance, MSMEs often lack the infrastructure, knowledge and resources to implement traceability and ESG (Environmental, Social and Governance) reporting systems that are commonly adopted by larger firms. The APEC project CTI 207 2023A addresses this gap by proposing a simplified, scalable methodology using Global Data Standards (GDS) that allows MSMEs to capture and share traceability and ESG credentials in a cost-effective and standardized way. Pilot results across People's Republic of China; Indonesia and Peru demonstrate that with the right tools—such as 2D Digital Link, GS1 identifiers and open data exchange formats like EPCIS—MSMEs can meaningfully participate in transparent, sustainable trade ecosystems. Moreover, integrating ESG values into traceability efforts positions MSMEs to respond to growing global demand for ethically sourced, environmentally responsible products, aligning with APEC's broader goals for inclusive and green economic growth.

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[1] https://apfcanada-msme.ca/about-us/. *MSMEs make up 97 percent of all businesses in the APEC region, employ over half of the regional workforce and contribute 40 to 60 percent of GDP in most economies.*

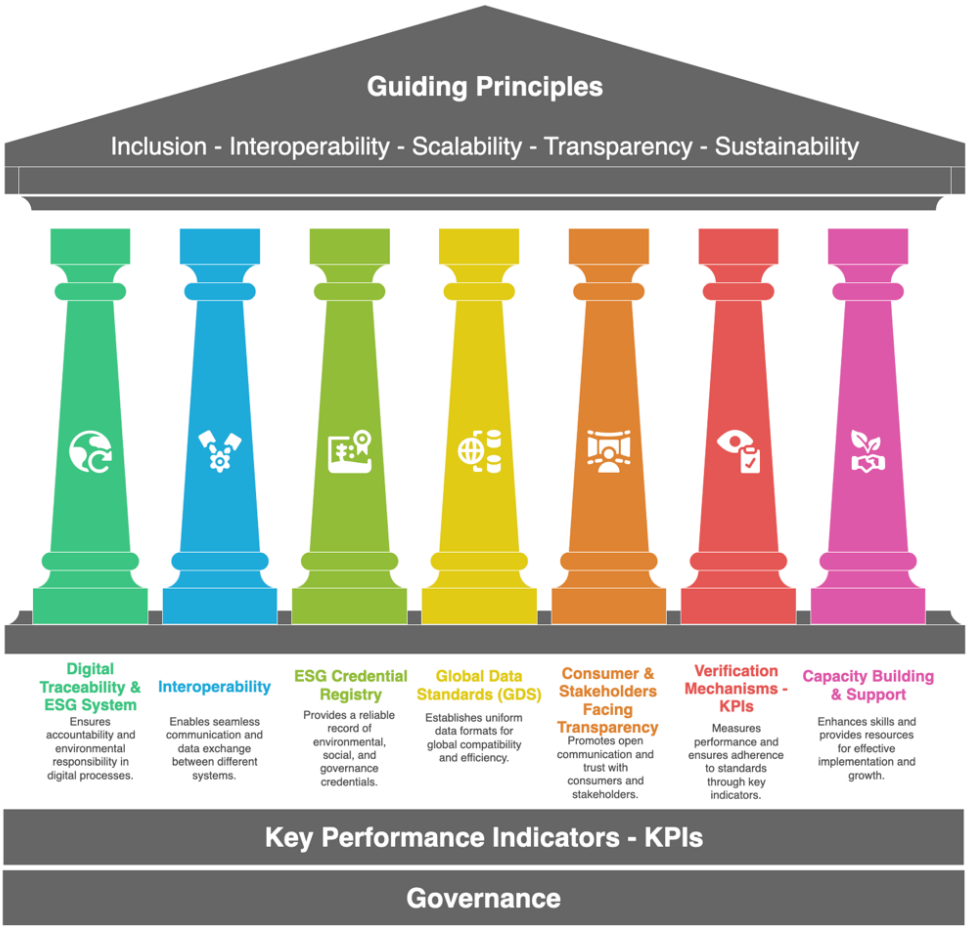
[2] *https://www.apec.org/docs/default-source/publications/2024/11/224_psu_scfap-iii-mid-term-review.pdf?sfvrsn=d4fd796b_1*

[3] *https://www.apec.org/docs/default-source/publications/2024/1/224_psu_resilient-supply-chain.pdf?sfvrsn=c115092d_2*

### 3.2.2. Purpose

This framework aims to guide APEC economies—especially Micro, Small and Medium Enterprises (MSMEs)—in adopting digital traceability systems integrated with Environmental, Social and Governance (ESG) credentials to strengthen:

a. **End-to-end transparency** in supply chains.
b. **MSMEs' competitiveness** in global markets.
c. **Consumer trust** through verified and visible product information.
d. Alignment with APEC's priorities for innovative and sustainable growth.




The main components of the framework are those set out in Figure 1.

*Figure 1 – Framework Main Components. Source: Own Elaboration*

### 3.2.3. Guiding Principles

Within the Guiding Principles selected for this Framework, it's important to highlight that Interoperability and Transparency are foundational elements for achieving effective digital transformation in supply chains. In the context of this project, their inclusion will be both as *Guiding Principles* and as *Core Pillars,* as they are essential to ensure systems are trustworthy, scalable and aligned with global trade requirements.

As *Guiding Principles*, both interoperability and transparency represent cross-cutting values that must inform every decision—from system architecture and data governance to stakeholder engagement. Interoperability reflects the commitment to openness, compatibility and alignment with international standards—such as GS1 Global Data

Standards (e.g., GTIN, GLN, EPCIS)—which are critical to enabling seamless data exchange across platforms, sectors and economies. Transparency, in turn, reinforces the project's objective of fostering greater trust among supply chain actors by ensuring that relevant product, traceability and ESG data is accessible, reliable and verifiable throughout the value chain.

As *Core Pillars*, these elements also serve as structural enablers for implementation. Interoperability drives practical measures such as the development of APIs, harmonization of data models and agreements between public and private platforms. Meanwhile, transparency requires clear protocols for digital documentation and data verification, encouraging the inclusion of MSMEs and reducing asymmetries of information in international trade. Together, they support the deployment of traceability and ESG systems that are interoperable, inclusive and compliant with emerging global regulations—such as the EU Deforestation Regulation or Digital Product Passports, among others.

Recognizing interoperability and transparency in both dimensions—principle and pillar—enables a holistic, resilient approach to digital supply chain transformation. It ensures that these values are embedded not only in the design philosophy, but also in the practical tools, workflows and governance models adopted throughout the roadmap. This dual recognition strengthens regional alignment and fosters long-term impact across APEC economies. Following the main Guiding Principles for this Framework:

a. **Inclusion:** Ensure accessibility for MSMEs across diverse sectors by offering low-cost, easy-to-implement tools and training programs adapted to different levels of digital maturity.

b. **Interoperability:** The most effective way to ensure interoperability is using global standards for the identification of products and locations across both global and local supply chains. For this reason, the first phase of this project included a global benchmarking of the most widely adopted standards in both the public and private sectors. The results confirmed that GS1 standards are the most broadly implemented worldwide. Therefore, it is recommended to promote the use of open global standards, such as those from GS1[4] (e.g., Global Trade Item Numbers - GTIN, Global Location Numbers - GLN, Electronic Product Code Information Services - EPCIS), to enable seamless and reliable data exchange across different systems and APEC economies. By aligning with globally recognized standards, economies not only ensure interoperability but also support the inclusion of MSMEs in international trade through scalable and cost-effective digital tools.

c. **Scalability:** Provide a model that can evolve from basic traceability to full ESG credentials integration as businesses grow or regulatory demands increase, across industries and economy sizes.

d. **Transparency:** Foster consumer confidence by enabling visibility into product origins and the full product lifecycle, including ESG practices, through consumer-facing interfaces.

[4] *GS1 – Global Standards One is a not-for-profit, international organization that develops and maintains global standards for business communication. Best known for the barcode and 2D Digital Link, GS1 standards enable the unique identification, capture and sharing of information about products, locations and assets in supply chains across the world, supporting efficiency, traceability and interoperability in global trade.*

e. **Sustainability:** Embed ESG principles in all phases of supply chain traceability implementation, from production to distribution to the final consumers.

### 3.2.4. Core Pillars

The following Core Pillars represent the key dimensions or structural components upon which the proposed strategy and framework are built. They are aligned with international best practices as well as with key recommendations and findings from existing APEC studies, documents and related projects. A detailed list of these references can be found in *9.3. Global Background and APEC References on Supply Chain Transparency, Traceability, Visibility, and ESG Credentials* at the end of this report.

a. **Digital Traceability and ESG System**.
Implement systems that enable the digital capture, storage, and secure sharing of event-based supply chain data using globally recognized standards such as EPCIS (Electronic Product Code Information Services). This includes the use of standardized identifiers like Global Trade Item Numbers (GTIN) for products and Global Location Numbers (GLN) for supply chain sites. These systems should ensure that data related to product origin, movement, transformation and environmental, social and governance (ESG) attributes is recorded in real-time and can be reliably accessed across the entire supply chain. Importantly, this traceability must extend to upstream producers, particularly MSMEs, allowing them to digitally document their processes and contribute to transparent and verifiable supply chain records. This approach supports compliance with international trade requirements, fosters trust among stakeholders and enhances the market competitiveness of smaller enterprises by aligning them with global digital ecosystems.

b. **Interoperability between public and private platforms.**

b.1. **Enables End-to-End Visibility Across the Supply Chain**
Interoperability allows seamless data flow between different systems—from smallholder producers using private traceability platforms to regulatory bodies and government using public systems. This end-to-end integration ensures that traceability and ESG credentials remain consistent, verifiable and accessible at all points in the chain.

b.2. **Supports Regulatory Compliance and Market Access**
Many international regulations - such as the EU Deforestation Regulation and the Digital Product Passport, among others - require traceability and ESG data to be digitally verifiable. Interoperability between private sector data platforms and government portals ensures that companies, especially MSMEs, can meet these regulatory requirements efficiently.

b.3. **Avoids Data Silos and Duplicated Efforts**
Lack of interoperability leads to duplicated data entry, inconsistent records and siloed platforms that limit scalability. Integrated systems reduce administrative burdens and foster data reuse, saving time and cost across both sectors.

b.4. **Strengthens Trust and Transparency Across Stakeholders**
When private companies and public agencies share common data frameworks (e.g., GS1 standards), they can validate and cross-check ESG claims, certifications and traceability logs more reliably. This enhances market trust and credibility of sustainability claims.

b.5. **Empowers MSMEs to Participate in Digital Supply Chains**
Many MSMEs already use lightweight private-sector solutions (e.g., mobile apps, web-based platforms). Connecting these with government databases

ensures that even the smallest actors can contribute to and benefit from a transparent, interoperable digital ecosystem.

b.6. **Builds a Scalable Model for Other Industries and Economies**
Pilots like APEC CTI 207 2023A demonstrate that interoperability is feasible and valuable. Scaling such efforts requires public-private integration that supports replicability in other regions, products, and value chains.

c. **ESG Credential Registry:**
Maintain ESG data alongside product records, such as certifications, reports and audit results, among others. Linked databases to store and verify ESG-related information, such as sustainability certifications, emissions records, biodiversity conservation, labor practices and community impact.

d. **Global Data Standards (GDS):**
Utilize GS1 standards, including 2D barcodes with Digital Link, for consistency and digital interoperability across supply chains and align government traceability systems with global standards. Within the APEC context, several studies have underscored the importance of adopting GDS to enhance supply chain connectivity and visibility.

These include the *APEC Guidelines and Best Practices for the Adoption of Global Data Standards*[5], as well as the *Study on the Application of GDS for APEC Supply Chain Connectivity – Phase 1*[6] *and Phase 2*[7]. These foundational documents provide valuable insights and practical recommendations that reinforce the role of GDS as a strategic enabler for digital trade and traceability initiatives across the region. A detailed list of these references can be found in *Annex 9.3. Global Background and APEC References on Supply Chain Transparency, Traceability, Visibility, and ESG Credentials* at the end of this report.

e. **Consumer and Stakeholders Facing Transparency**:
Enable consumers and all related stakeholders of the supply chain access extended product data using 2D codes embedded on packaging, leveraging GS1 Digital Link to provide structured, real-time access to information such as product origin, traceability records, ESG credentials and compliance data—improving data accuracy, regulatory alignment and stakeholder trust across the supply chain. For example, in the APEC pilot conducted in Peru's coffee sector, 2D codes were successfully printed directly on the exported coffee jute bags, allowing downstream partners and international buyers to access traceability and ESG data throughout the journey from farm to port.

In contrast, in the Indonesian coffee pilot, the 2D code was applied directly to the retail-ready packaging intended for the end consumer at the point of sale, offering immediate access to key product information and ESG credentials—thereby enhancing transparency and consumer engagement at the last mile.

[5] *https://www.apec.org/docs/default-source/publications/2020/3/apec-guidelines-and-best-practices-for-the-adoption-of-global-data-standards/220_cti_apec-guidelines-and-best-practice-for-the-adoption-of-gds.pdf?sfvrsn=fb304fc6_1*
[6] https://www.apec.org/docs/default-source/publications/2017/2/study-on-the-application-of-global-data-standards-for-apec-supply-chain-connectivity-phase-1/217_psu_170130-apec-gds-final.pdf
[7] https://www.apec.org/docs/default-source/publications/2017/11/study-on-the-application-of-gds-for-supply-chain-connectivity---phase-2/217_psu_study-on-the-application-of-global-data-standards-for-supply-chain-connectivity-phase-2.pdf

f. **Verification Mechanisms**:
Implement third-party validation systems to ensure authenticity and accuracy of ESG claims. Enable close collaboration with and between certification bodies and industry associations and groups, to integrate standardized product and enterprise identifiers, allowing traceability platforms to connect with trusted ESG data sources and enhance data reliability and credibility of the information generated.

g. **Capacity Building & Support**:
This topic is a cornerstone of APEC's agenda, especially in advancing inclusive and sustainable growth. As economies face growing demands for digitalization, environmental compliance and supply chain resilience, capacity building enables APEC members—particularly developing economies and MSMEs—to effectively implement international standards, adopt innovative technologies and participate more competitively in global trade. Through targeted training, knowledge sharing and technical assistance, APEC ensures that no economy or sector is left behind.

As highlighted in this report under Section 4.5.5. Risk Management, the analysis of risks during the pilot execution revealed significant differences in MSMEs' digital maturity—from enterprises operating with 100% manual processes to others with partially automated systems. These gaps, together with risks such as limited technical capacity, data reliability concerns, connectivity barriers and potential resistance to adoption, underscore the central role of capacity building in mitigating vulnerabilities and ensuring sustainability. Strengthening institutional and human capabilities not only addresses these risks but also fosters deeper regional integration, enhances policy implementation and accelerates progress toward shared economic and sustainability goals. The scope is to provide resources, training and support mechanisms to assist MSMEs in system adoption, promote capacity development programs tailored to MSMEs on traceability, ESG and Global Data Standards (GDS) and develop training modules, helpdesks and toolkits to support their digital and operational transition.

### 3.2.5. Implementation Phases

As this section is closely aligned with both the roadmap and the methodology designed and applied during the pilot projects—validated through their implementation—it will be further developed in detail in the corresponding chapter.

a. **PHASE 1 – PREPARATION AND ASSESSMENT**
This initial stage focused on conducting diagnostics of the MSMEs and ecosystems participating in the project implementation, establishes the foundation for successful implementation. It includes defining clear goals (regulatory compliance, market access, efficiency improvements) and determining the scope of products, processes or supply chains involved. The 12-question self-assessment tool developed in the project (*Annex 9.4.*) is applied to identify the company's digital maturity level, technological gaps, existing certifications and training needs. Supply chain actors are mapped, and roles and responsibilities assigned, while also integrating gender, age and education level to ensure inclusiveness. The outcome of this phase is a clear baseline, and an initial plan tailored to each MSME's real capacities.

b. **PHASE 2 – IDENTIFICATION AND PLANNING**
Building on the readiness assessment, a modular traceability model is designed in this phase for each sector/company. Products, lots and critical processes to be traced are identified, and GS1 Global Data Standards (GDS) are assigned (GTIN, GLN, 2D Digital Link, among others) to guarantee interoperability. Process and

data mapping is conducted to identify CTEs (Critical Tracking Events) and KDEs (Key Data Elements) and to design standard operating procedures and flow diagrams. In parallel, a digital traceability platform is selected or adapted, ranging from manual or Excel records to mobile or cloud-based applications. Technology enablement prioritized inclusivity: MSMEs without ERP systems adopted simple mobile and cloud-based tools, while larger companies explored API integrations with existing platforms. The design stage also addressed how ESG certifications (Fairtrade, GOTS, FSC, HACCP, etc.) would be digitally linked to products through trusted data sources. Training requirements for staff are defined, and traceability reports and basic manuals adapted to MSMEs are developed.

c. **PHASE 3 - DIGITAL REGISTRATION AND DOCUMENTATION**
During this stage, the traceability systems were tested in real-world operations and digital recording of information began. At this stage, Staff are trained in the use of the selected platform, user profiles are assigned and traceability and ESG data - ideally linked directly with certification bodies to ensure trusted data sources - are integrated. 2D Digital Link codes are generated to consolidate traceability and ESG information and even commercial value elements such as recipes, videos or awards to be access in a single scan. Field activities included training workshops for farmers, cooperatives and factory staff, as well as the configuration of user roles (administrators and data loggers). In some cases, such as Peru's wood pilot, integration was achieved with existing government platforms (SERFOR's SNIFFS. Deployment validated that even MSMEs with zero digitalization could successfully participate when provided with accessible and localized tools.

d. **PHASE 4 - MONITORING, SIMULATION AND VALIDATION**
Implementations are evaluated against defined Key Performance Indicators (KPIs) covering supply chain coverage, data quality, ESG certification reliability, compliance with regulations, and business impact. Indicators measured included: percentage of suppliers with registries, percentage of processes digitized, error-free data records, compliance with local and international regulations, and consumer access to ESG information through 2D codes. Crisis simulations were also conducted to test the capacity to trace and isolate batches in real time. In addition, social impact metrics—such as the number of digitally connected MSMEs, women-led enterprises, and youth participation—were collected to reinforce inclusivity. Cost-benefit estimations highlighted productivity improvements and increased consumer trust.

e. **PHASE 5 - SCALING AND SUSTAINABILITY**
The final phase seeks to consolidate and expand results. It includes internal scaling to more products, processes or business units within the same organization, and extension to new markets and sectors. Integration with external systems (ERPs, single windows, certification registries) is promoted, while communication and commercial positioning strategies are developed, leveraging 2D codes to strengthen consumer trust and market differentiation. Governments play a critical role by ensuring their platforms are built on Global Data Standards (GDS) and interoperable with private systems. Finally, this phase incorporates risk management, continuous financing (through public funds, international institutions or Public–Private Partnerships - PPP) and ongoing capacity building, ensuring that traceability and ESG credential systems remain sustainable and evolve over time.

### 3.2.6. Governance Structure

Define clear governance structures and establish working groups in each economy including government, MSMEs, private sector and certification bodies.

a. **Local Coordinating Entity:** Responsible for leading implementation within each economy implementation and ensuring policy alignment, linked to ministries or trade facilitation bodies.
b. **Stakeholder Council:** Comprising MSMEs, private sector representatives, industry leaders, regulators, Non-Governmental Organizations (NGOs) and consumers to ensure holistic governance.
c. **Technical Committee:** Multidisciplinary experts in ESG metrics, IT systems, supply chain operations and Global Data Standards (GDS) to provide technical guidance and oversight.

### 3.2.7. Key Outputs and Tools

a. **Digital Traceability Toolkit:** Practical guides, templates and FAQs for MSMEs and regulators.
b. **Standard ESG Templates:** Simple, customizable forms for entering ESG data such as carbon footprint, certifications, labor practices, among others.
c. **Sector Workflows:** Visual maps and procedural guides tailored to product supply chains outlining key traceability and ESG checkpoints.
d. **Consumer Interfaces:** Mobile/Web interfaces using 2D codes Digital Link for extended product visibility and sustainable data.
e. **Monitoring Dashboard:** Basic KPIs dashboards for local authorities to track implementation progress.

### 3.2.8. Monitoring & Evaluation – Key Performance Indicators (KPIs)

Monitoring and evaluation are essential to ensure the success and scalability of digital traceability and ESG systems. Establishing Key Performance Indicators (KPIs) allows stakeholders to measure the effectiveness, efficiency and impact of implementation efforts. KPIs provide data-driven insights to identify gaps, monitor progress over time and support evidence-based decision-making. In the context of this framework, KPIs also promote transparency and accountability among public and private actors, helping to align initiatives with regional and international standards.

All KPIs related to traceability and ESG (Environmental, Social, and Governance) are strategically relevant and have high potential impact. The main issue is not prioritizing one KPI over another in absolute terms, but rather selecting those that are most applicable depending on the company's specific context. Core variables include the type of company (manufacturing, agribusiness, retail, logistics), the sector (food, textiles, wood, health, energy), company size (MSMEs vs. large corporations) and the objectives pursued (regulatory compliance, operational efficiency, market access, sustainability, reputation).

In addition, other factors such as digital maturity (the company's level of technology adoption and readiness), applicable regulations (specific legal frameworks and compliance requirements), resource capacity (availability of financial and human resources), position in the supply chain (whether the company is a producer, processor, distributor or retailer), destination markets (local vs. international and their regulatory demands), corporate sustainability commitments (public ESG goals and reporting frameworks) and risk exposure (the degree of reputational, operational, or compliance risk in the industry) also shape the selection of KPIs.

The following KPIs were selected based on the observations made during the execution of the pilot projects. While the list is broad, we have highlighted from among all possible indicators those that, considering the pilot results, are the most critical for measuring success, as well as for their strategic relevance, applicability and potential impact.

| KPI | DESCRIPTION | CALCULATION METHOD | SUGGESTED FREQUENCY |
|---|---|---|---|
| **PRODUCT AND PROCESS COVERAGE** | | | |
| % of traceable products | Measures the proportion of total products that are traceable within the system | (Number of traceable products ÷ Total number of products) × 100 | Quarterly |
| % of traceable batches | Indicates how many production batches are traceable out of the total produced | (Number of traceable batches ÷ Total number of batches) × 100 | Quarterly |
| % of critical processes covered by traceability | Shows the extent to which key business processes are covered by traceability | (Number of critical processes with traceability ÷ Total number of critical processes) × 100 | Annually |
| % of suppliers with Traceability registries | Assesses the proportion of suppliers that demonstrate have traceability registries. This reflects the company's ability to cascade traceability across its supply chain. | (Number of suppliers with Traceability registries ÷ Total number of suppliers) × 100 | Annually |
| Traceability granularity level (unit, batch, case, pallet) | Defines the depth of traceability, e.g., by individual unit, batch, case or pallets | Qualitative indicator: Level of detail at which traceability is applied | Annually |
| **DATA QUALITY AND ACCURACY** | | | |
| % of records with complete information | Measures the proportion of records that contain all required fields and data points | (Number of complete records ÷ Total number of records) × 100 | Monthly |
| % of error-free records | Indicates the accuracy of records by identifying those free of errors | (Number of records without errors ÷ Total number of records) × 100 | Monthly |
| Average registration time | Average time required to register a single data record in the traceability system | (Total time spent on data registration ÷ Number of records) | Monthly |
| % of integration with internal systems (ERP/WMS/Others) | Measures the level of connectivity of traceability with existing enterprise systems | (Number of systems integrated ÷ Total systems identified for integration) × 100 | Annually |
| **RESPONSE TIME AND VISIBILITY** | | | |
| Average trace-back time (from product to origin) | Average time required to trace a product back to its point of origin | (Σ Time taken to trace products back ÷ Number of trace tests) | Quarterly |
| Average trace-forward time (from origin to destination) | Average time required to trace products forward through the supply chain to destination. | (Σ Time taken to trace products forward ÷ Number of trace tests) | Quarterly |
| % of events visible in real time | Proportion of supply chain events that are visible and tracked in real time. | (Number of events monitored in real time ÷ Total number of events) × 100 | Quarterly |
| Level of interoperability with supply chain partners | Indicates the degree of interoperability and data exchange with partners. | Qualitative/Quantitative index. (% of partners connected to traceability platform) | Annually |

| KPI | DESCRIPTION | CALCULATION METHOD | SUGGESTED FREQUENCY |
|---|---|---|---|
| **REGULATORY COMPLIANCE AND AUDITS** | | | |
| % of compliance with applicable traceability regulations | Measures compliance with legal and regulatory requirements for traceability. | (Number of requirements met ÷ Total applicable requirements) × 100 | Annually |
| Number of audits passed without findings | Indicates the number of external or internal audits passed without issues. | Count of audits with zero non-conformities | Annually |
| Average response time to an audit | Average time taken to prepare and respond to audit requirements. | (Σ Response time to audit requests ÷ Number of audits) | Per Audit |
| **BUSINESS AND MANAGEMENT IMPACT** | | | |
| Reduction in product recall time | Measures the reduction in time required to execute a product recall compared to baseline. | (Baseline recall time – Current recall time) ÷ Baseline recall time × 100 | Annually |
| % of customer claims resolved through traceability | Shows the proportion of customer complaints resolved using traceability data. | (Number of claims resolved using traceability ÷ Total claims) × 100 | Quarterly |
| % increase in customer trust (measured through surveys) | Indicates improvements in customer confidence measured via surveys. | ((Current survey trust score – Previous score) ÷ Previous score)) × 100 | Annually |
| % reduction in losses or waste due to lack of traceability | Shows reductions in losses or waste attributed to improved traceability practices. | (Baseline losses/waste – Current losses/waste) ÷ Baseline losses/waste × 100 | Annually |
| Digital Traceability Adoption and Productivity Improvement | This indicator measures the improvement achieved by moving from 100% manual record-keeping (paper-based) to digital traceability solutions. It captures three main dimensions:<br>1. Adoption of digital solutions (share of records registered digitally),<br>2. Reduction of errors (decrease in mistakes caused by manual data entry) and<br>3.Productivity gains (time saved in registering information).<br>The indicator highlights efficiency, accuracy and reliability improvements in data management as a result of digitalization. | <u>Digitalization rate</u> (%):<br>(Number of records registered digitally ÷ Total number of records) x 100<br><br><u>Manual error rate</u> (%):<br>(Manual error rate – Digital error rate) ÷ Manual error rate) x 100<br><br><u>Productivity Gain</u> (%):<br>(Baseline average registration time - Current digital registration time) ÷ Baseline average time × 100 | Quarterly |
| **ESG CREDENTIALS IMPLEMENTATION** | | | |
| % of products/processes with verified sustainability certifications | Measures the share of a company's products or processes that hold third-party verified sustainability certifications (e.g., FSC, Fairtrade, Rainforest Alliance, ISO 14001). | (Number of certified products/processes ÷ Total number of products/processes) × 100 | Annually |

| KPI | DESCRIPTION | CALCULATION METHOD | SUGGESTED FREQUENCY |
|---|---|---|---|
| % of suppliers with ESG compliance or sustainability credentials | Assesses the proportion of suppliers that demonstrate compliance with ESG standards or hold recognized sustainability credentials. This reflects the company's ability to cascade ESG practices across its supply chain. | (Number of suppliers with ESG compliance credentials ÷ Total number of suppliers) × 100 | Annually |
| % of customer claims resolved with ESG data transparency | Indicates how many customer claims (e.g., related to sustainability, labor practices, environmental impact, or product origin) are resolved using verified ESG data or credentials. This measures both consumer trust and the usefulness of ESG information. | (Number of claims resolved using ESG data ÷ Total number of claims) × 100 | Quarterly |
| **GDS - GLOBAL DATA STANDARDS** | | | |
| Global Data Standards - GDS adoption rate | Use of GDS, GS1 Standards (such as GTIN, GLN, SSCC and GS1 Digital Link in 2D codes) as data carriers to enable digital traceability, ensuring interoperability, data accuracy and accessibility. | (Number of products using GDS GS1compliant codes ÷ Total number of products) × 100 | Quarterly |
| Average response time to an audit | Average time taken to prepare and respond to audit requirements. | (Σ Response time to audit requests ÷ Number of audits) | Per Audit |

### 3.2.9. Expectations and Needs of Interested Parties

Traceability and ESG stakeholders are organizations or individuals who have interests in any decision or activity. Interests generate relationships, even if the organizations or individuals are not aware of it. Therefore, it is important to identify stakeholders (see Figure 2) and engage them regarding interests that may actually or potentially be the basis of a complaint.

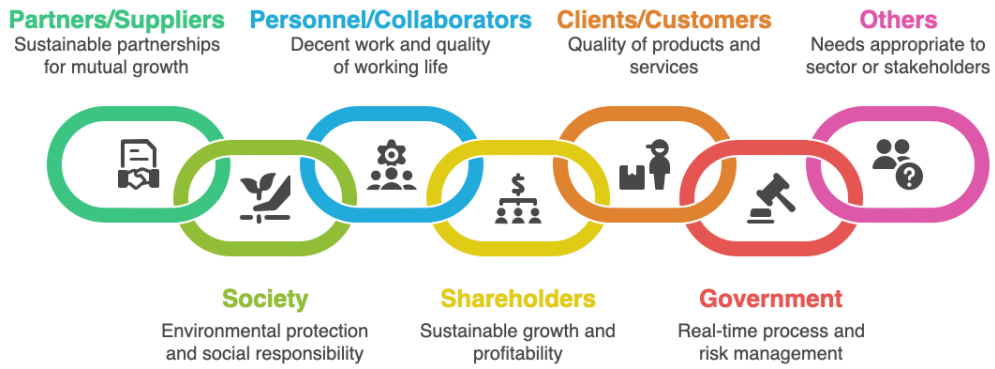



*Figure 2 – Interests and needs of Main Stakeholders. Source: Own Elaboration*

### 3.2.10. Enabling Conditions

This section presents the list of enabling conditions identified in each economy, highlighting the institutional, technological and regulatory elements that contributed to the successful implementation of the pilots. We have identified the following conditions:

a. Regulatory and institutional support.

b. Access to infrastructure and digital tools.

c. International Cooperation.

d. Use of Technology: EPCIS, 2D Codes Digital Link, APIs, Digital Registries.

e. Stakeholder Roles: Governments, Certification Bodies, GS1 Member Organizations, MSMEs, NGOs and

f. Alignment with APEC Goals: Trade facilitation, inclusiveness, digital transformation.

| Enabling Conditions | People's Republic of China | Indonesia | Peru |
|---|---|---|---|
| **Regulatory and institutional support** | Pilot received support from the Ministry of Commerce and the State Administration for Market Regulation. | Strong collaboration with key government ministries, including the Ministry of Trade through CTI-Indonesia and the Ministry of Agriculture, provided guidance, resources, and formal endorsement, facilitating MSME engagement and project legitimacy. | Support, inputs and permanent collaboration between several public and private organizations as MINCETUR, the Ministry of Agriculture, SERFOR (National Forest and Wildlife Service), among others |
| **Access to infrastructure and digital tools** | Using existing platform with add-on capability of traceability and ESG information. | Leveraged GS1 Peru platform and applications, which enabled adoption of GS1 Digital Link 2D barcode and accurate data management. | |
| **International cooperation** | Cooperated throughout the project with People's Republic of China; Indonesia and Peru. | | |
| **Use of technology** | Global Standard EPCIS used to capture events; 2D Digital Link Codes to access product information; synchronized via multiple APIs and digital registries. | The participating MSMEs were able to leverage the platform and applications provided by GS1 Peru. This technological support significantly simplified the adoption and implementation of the GS1 Digital Link 2D barcode, enabling seamless integration into their operations and ensuring accurate data management. | |

| Enabling Conditions | People's Republic of China | Indonesia | Peru |
|---|---|---|---|
| **Stakeholder roles** | **Government:** Focus on policy and enterprise guidance to drive the project forward. | | |
| | **Certification Bodies:** Collaborate with the China Quality Certification Center (CQC) to open APIs that link certificates (e.g., quality, ESG certificates), enabling the establishment of trusted data sources. | NA | NA |
| | **NGO (Non-Governmental Organization):** Cooperate with the Social Responsibility Office of the China National Textile and Apparel Council (CNTAC) to directly connect product digital identities to trusted data sources, facilitating easy access to carbon footprint reports. | NA | **NGO (Non-Governmental Organization):** Peruvian Coffee and Cacao Association to support in the methodology, framework and roadmap validation and connect products with digital trusted registries and data sources |
| | **GS1 (Global Standards One):** Apply international standards to issue globally unified identifiers for upstream and downstream supply chain entities and products, provide and develop one-stop platform; additionally undertake pre-project enterprise research, pilot enterprise selection, formulation of implementation roadmaps, and offer guidance on digitalization and training to MSMEs. | | |
| | **MSMEs:** Actively participate in the project pilot, provide supply chain information and cooperate in conducting process analysis and digital planning. | | |
| **Alignment with APEC goals** | Supported trade facilitation, inclusiveness and digital transformation by helping MSMEs use global standards and digital tools to share product information with consumers, regulators and partners. | | |

## 4. ROADMAP FOR THE IMPLEMENTATION OF TRACEABILITY RECORDS AND ESG CREDENTIALS IN MSMEs

This part of the report is focus on a strategic implementation guide that outlines the key steps, timelines and responsibilities required to scale the adoption of digital traceability and ESG credential systems across supply chains. It serves as a practical, action-oriented framework designed to support MSMEs and other stakeholders in aligning with Global Data Standards (GDS), promoting interoperability and enhancing transparency. The roadmap builds on the findings of pilot projects, incorporates lessons learned and provides a phased approach to achieving broader regional integration within the APEC economies.

The general objective of this roadmap is to guide MSMEs in the digital adoption of traceability records and ESG (Environmental, Social, and Governance) credentials using Global Data Standards (GDS), to meet international requirements, improve competitiveness, and facilitate trade within APEC.

Figure 3 shows the five phases that constitute the roadmap outlined in this report.

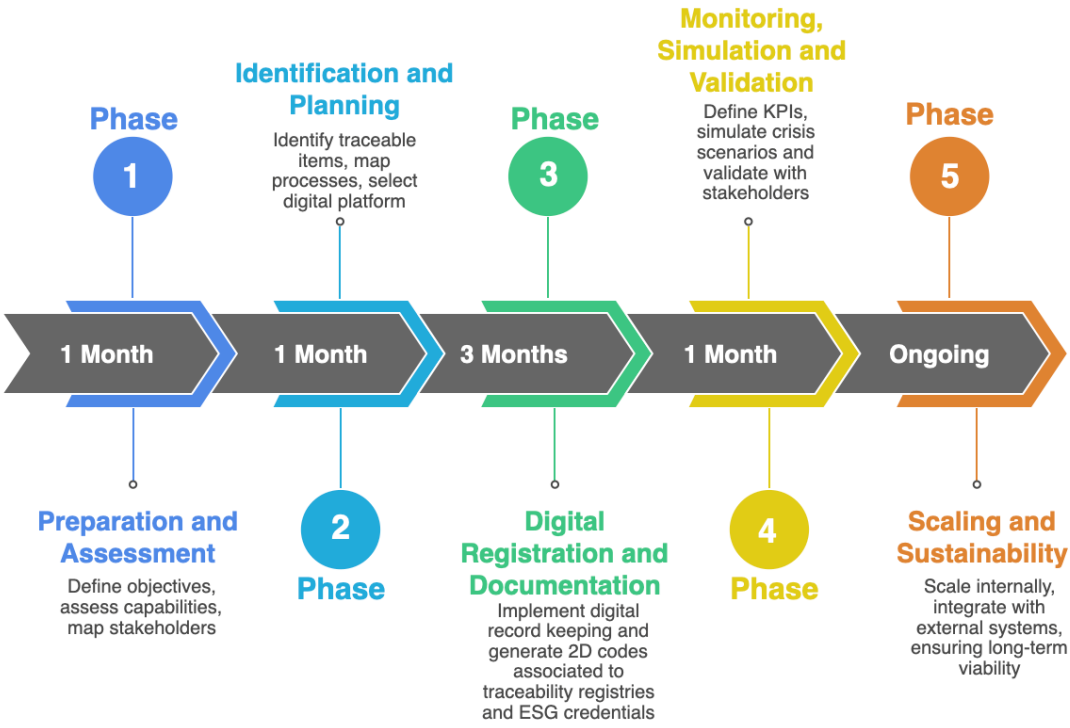



*Figure 3 – Roadmap Five (05) Phases. Source: Own Elaboration*

This roadmap is adaptable to various sectors and levels of digital maturity. The proposed methodology has been successfully field-tested in six supply chains across People's Republic of China; Indonesia and Peru, demonstrating its applicability in diverse contexts. To ensure sustainable results and effective implementation, it is essential to provide technical support and training before, during, and after deployment—highlighting the critical importance of Capacity Building as a foundation for long-term success.

## 4.1. PHASE 1 – PREPARATION AND ASSESMENT

### 4.1.1. Objectives and Scope

a. Set clear goals: compliance with which regulatory, legal, environmental (Domestic and International Regulations) and risk management requirements; investment to access new markets; differentiation and internal efficiency improvement (process optimization), among others.
b. Define whether implementation will apply to all company products or only to certain supply chains or specific items, locations, internal processes, actors in the supply chain.
c. Define short term benefits and key success factors of the project implementation for example speed, data quality, access to global markets, among others.

### 4.1.2. Assessment of Internal Capabilities

In line with the recommendations provided in the *Midterm Report 1 – Research and Design of Standardized Processes, using global data standards for digital exchange of traceability and ESG credentials*, the assessment must be applied at this stage of the roadmap to identify the baseline conditions of the companies. An essential element of the methodology, this tool offers a simplified questionnaire of 12 questions formulated in non-technical language (see *Annex 9.4*.). The assessment plays a critical role in determining the specific needs of each MSME before initiating the implementation of traceability records and ESG credentials. By capturing information on processes, products, existing certifications, technological tools and organizational practices, the questionnaire enables companies to map their status, recognize critical tracking events (CTEs) and key data elements (KDEs), and determine their readiness level. This baseline not only guides the customization of the implementation plan but also ensures that the methodology and the adoption of Global Data Standards are aligned with the real capacities and requirements of each enterprise, thereby increasing the likelihood of successful and sustainable adoption. This assessment includes the following key points:

a. Gather information on current management systems, whether manual or digital (paper forms, existing traceability systems, Excel, ERP, WMS, portable devices, etc.), evaluating aspects such as: information security, storage capacity and times, access to information, etc.
b. Digital Maturity level of the company and Global Data Standards level of usage.
c. Identify technological gaps and training needs on both traceability/ESG concepts and digital tools. Previous training is very important for successful implementation.
d. Identify existing traceability and ESG certifications (e.g., FSC, HACCP, Organic, Fair Trade, GOTS and OEKO-TEX for textiles, among others) as a foundation for the digital integration of these credentials.
e. Identify other restrictions apply to the project (budget, technology, human resources, others)
f. Designate key roles for project management. Prioritize internal team members and external professionals when necessary. Select the most qualified candidates for the project manager and technical specialist positions, ensuring their expertise and skills align with the project's requirements.

### 4.1.3. Identification of Key Stakeholders

a. Map all supply chain participants (raw material suppliers, producers, aggregators, processors, exporters, etc.).
b. Assign roles and responsibilities for project (direction, data collection and registration).
c. Include gender, age, education level, and other relevant aspects in stakeholder characterization.

d. Determine and summarize parties in scope of the traceability project (internal and external), their roles in the supply chain and locations, e.g., identify plants, warehouses, distribution centers, third party cold storage facilities, etc.

## 4.2. PHASE 2 – IDENTIFICATION AND PLANNING

### 4.2.1. Identification of Traceable Items and Assignment of GDS Identifiers

Through local GS1 member organizations in each economy:

a. GTIN (Global Trade Item Number) for products, commercial presentations and other logistics units, if applicable.

b. GLN (Global Location Number) to identify production, logistics, and administrative locations. Identifying physical locations for the digital world.

c. GDTI (Global Document Type Identifier) for physical or electronic documents, not used in this pilot, but essential since many documents from participants lacked identifiers.

d. 2D codes with Digital Link provide instant access to product data like traceability and ESG credentials, enhancing transparency and user experience with a single scan.

e. Review the physical identification and data carriers used by the company (barcoding, labelling, RFID Tags) to identify traceable object.

f. Determine if they support customer and regulatory requirements and if there are specific marking requirements for data carriers such as linear, 2D, and RFID, e.g., healthcare, fisheries, fresh foods, etc.

In Figure 4 and Figure 5 there are a set of examples of GS1 GDS Identifiers., including 2D Digital Link.

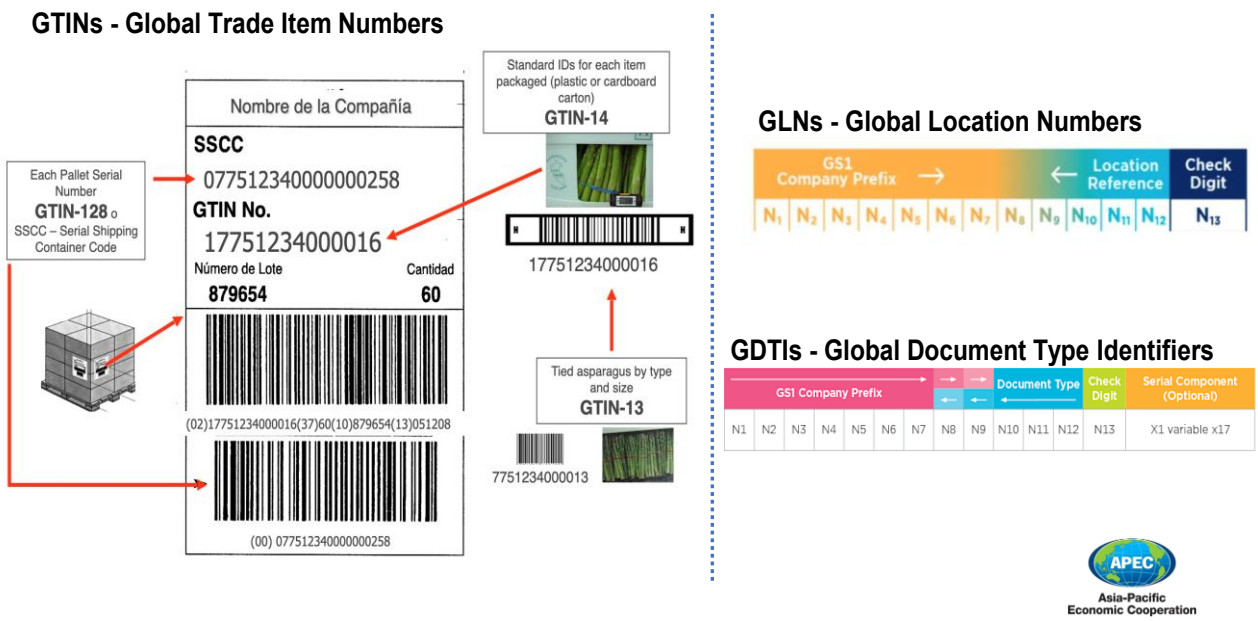



*Figure 4 – Example of GS1 GDS Identifiers. Source: Own Elaboration*

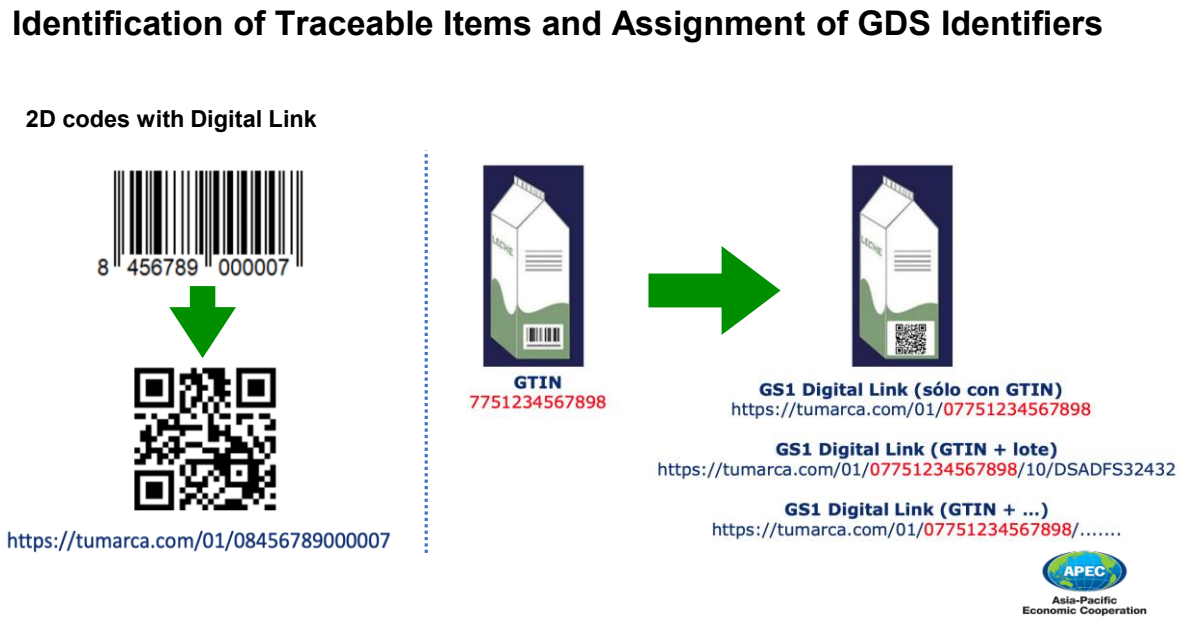



*Figure 5 – Example of GS1 GDS Identifiers: 2D Digital Link. Source: Own Elaboration*

### 4.2.2. Process and Data Mapping

a. Identify CTEs (Critical Tracking Events) such as raw material reception, processing, packaging, dispatch, etc.
b. Identify KDEs (Key Data Elements) like dates, quantities, responsible parties and associated ESG certifications, etc.
c. Map process flow diagrams and standard operating procedures, including product recalls, crisis management and system monitoring. It is desirable that these processes be included in a Traceability Manual or similar document
d. Store the collecting database and define the data structure in the digital format following the global data traceability standard.
e. Identify other processes related to recall and food security

In Figure 6 is shown an example of the Process and Data Mapping for Peruvian Coffee Supply Chain and in Figure 7 an example of part of the data structure definition for the customization of the visibility platform for the same supply chain.

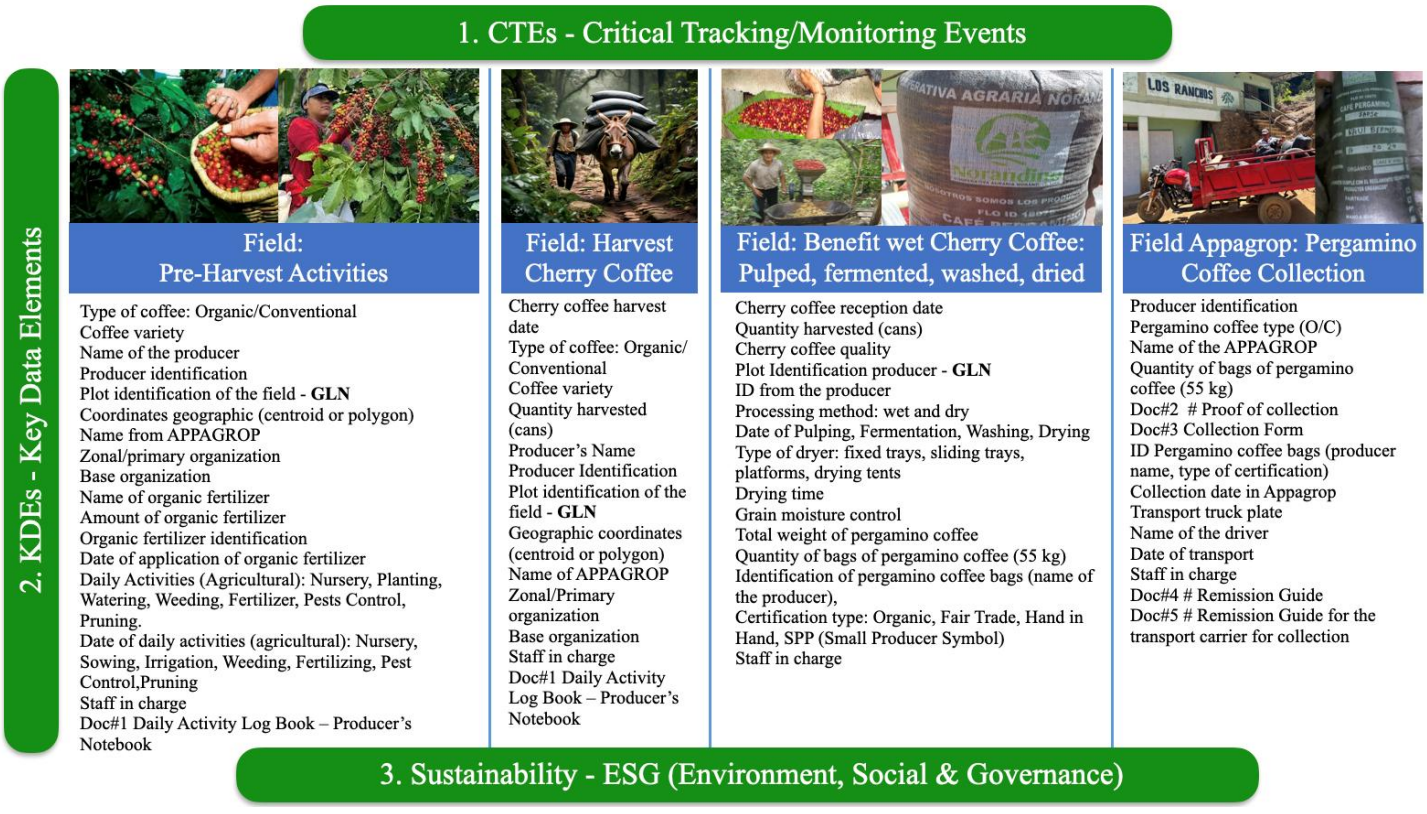



*Figure 6 - Peruvian Coffee Process and Data mapping. Source: Own Elaboration.*

| APEC PROJECT<br>Coffee Supply Chain Process Map – AGRARIAN COOPERATIVE NORANDINO LTDA | | | | | |
|---|---|---|---|---|---|
| **Processes/CTE´s (Critical Tracking Elements)** | **Data/KDE´s (Key Data Elements)** | **Data Type** | **Data Length** | **Data Property** | **Capture Format** |
| **FIELD ACTIVITIES** | | | | | |
| **Field: Activities Pre-Harvest** | Type of coffee: Organic/conventional | Alphabetical | 15 | Operations | Paper Forms |
| | Coffee variety | Alphabetical | 15 | Quality/certifications | Paper Forms |
| | Name of the producer | Alphabetical | 30 | Quality/certifications | Paper Forms |
| | Producer identification | Alphanumeric | 10 | Quality/certifications | Paper Forms |
| | Plot identification of the field-GLN | Numeric | 13 | Quality/certifications | Paper Forms |
| | Coordinates geographic (centroid or polygon) | Decimal | min 10 | Quality/certifications | GPS Device |
| | Name from APPAGROP | Alphabetical | 30 | Quality/certifications | Paper Forms |
| | Zonal/primary organization | Alphabetical | 30 | Quality/certifications | Paper Forms |
| | Base organization | Alphabetical | 30 | Quality/certifications | Paper Forms |
| | Name of organic fertilizer | Alphabetical | 20 | Quality/certifications | Paper Forms |
| | Amount of organic fertilizer | Numeric | 6 | Quality/certifications | Paper Forms |
| | Organic fertilizer identification | Alphanumeric | 10 | Quality/certifications | Paper Forms |
| | Date of application of organic fertilizer | Date | 6 | Quality/certifications | Paper Forms |
| | Daily Activities (Agricultural): Nursery, Planting,Watering, Weeding, Fertilizer, Pest Control, Pruning. | Alphabetical | 30 | Quality/certifications | Paper Forms |
| | Date of activities daily (agricultural): Nursery, Sowing, Irrigation, Weeding, Fertilizing, Pest Control, Pruning | Date | 6 | Quality/certifications | Paper Forms |
| | Staff in charge | Alphabetical | 30 | Operations | Paper Forms |

*Figure 7 - Example of part of the data structure definition for the customization of the visibility platform for Peruvian Coffee. Source: Own Elaboration.*

#### 4.2.3. Identification/Selection/Adaptation of a Digital Platform or another registry method

a. Depending on the digital maturity of the companies, the information will be recorded on a traceability platform, in handwritten records or Excel records.
b. Identify existing traceability platforms or applications suitable for MSMEs. These may include mandatory tools depending on sector and local regulations (e.g., SNIFFS for the forestry sector in Peru) and/or sector-specific tools (e.g., mobile apps for coffee, wood, palm sugar).

c. If a proprietary platform is needed, it is crucial to ensure interoperability with official systems, databases, or registries relevant to the supply chain where traceability and ESG exchange will be implemented. These systems may be managed by government entities, NGOs, or private sector associations (e.g., Agricultural Producers Registry in Peru). Integration with these sources not only simplifies data entry but also allows the use of officially validated information.
d. Define the responsibilities, expertise and skills required for the staff in charge of managing and using the traceability system once implemented.
e. Define the training material that should be developed when implementing the traceability system to train the traceability team and the staff involved in the impacted procedures
f. It is recommended to adopt existing platforms compatible with GS1 Global Data Standards (GDS), which enable efficient and interoperable traceability and ESG data exchange.
g. Design traceability reports that include GDS identifiers and product batch details to support recalls.
h. One key criterion for selecting a traceability platform is its compliance with global traceability standards, such as EPCIS for sharing traceability information and GDSN for exchanging master data. Even for MSMEs without the immediate need to share information, this characteristic of the chosen traceability tool will enable easy scalability in the future as more stakeholders or nodes emerge in its supply chain.
i. A key point in this stage is ensuring platform interoperability. Although companies are not directly responsible, governments must guarantee compatibility among systems of different public entities.

## 4.3. PHASE 3 – DIGITAL REGISTRATION AND DOCUMENTATION

### 4.3.1. Implementation of Digital Record keeping

a. Develop a training plan for using the traceability platform.
b. Assign user roles (e.g., data entry, data query, master data administration).
c. Input traceability and ESG data into the selected platform based on defined CTEs and KDEs.
d. Link/integrate ESG certificates, either manually or automatically (ideally via API directly connected to the issuing entity for reliability).
e. Define traceability and ESG information to be shared via the 2D standard code (Digital Link), aligned with the goals defined in Phase I.
f. Consolidate multiple codes into a single GS1-compliant 2D code, including the 2D code Digital Link generation.
g. Develop the platform maintenance and support plan
h. Develop standardized procedures for processing information sources from non-digital formats, such as paper forms, which, due to human or material resource limitations, cannot be entered directly into the traceability platform. This procedure must assign responsible parties, timelines, and quality controls for the information.

Is desirable the development of a Traceability Manual or similar document that include document processes, formats, control points, responsibilities, registration procedures and Global Data Standards to be used, as well as practical templates with MSMEs-adapted examples, covering product recalls, crisis management and system monitoring.

### 4.3.2. Generation of 2D Codes with Digital Link

a. Use available software tools to generate standards 2D codes digital link
b. Print and apply codes to products, giving access to traceability, ESG, origin, certifications, and other information to ensure transparency.

c. Use the codes as marketing tools, adding company info, awards, nutrition facts, recipes, promotion video, brand information, etc., for consumers and other stakeholders.

## 4.4. PHASE 4 – MONITORING, SIMULATION AND VALIDATION

### 4.4.1. Definition of KPIs (Key Performance Indicators)

In this section, we present the list of KPIs identified by each participating economy based on the pilot projects they implemented. These indicators reflect the specific needs and priorities of their respective contexts. For organizational purposes, the KPIs are arranged according to the classification established in Section 3.2.8. Monitoring & Evaluation – Key Performance Indicators (KPIs) of this report. As previously mentioned, this compilation is provided as a Recommended List of KPIs. Economies, sectors, companies, or product categories may select those KPIs that best align with their goals and implementation strategies. Additional KPIs not included in this suggested list may also be added, if deemed relevant.

a. **People's Republic of China**

| Category | KPI | Description |
|---|---|---|
| Product and Process Coverage | % of suppliers with traceability registries | Upstream supply chain related to product information and enterprise information that can be obtained through the platform (Supply Chain Coverage) |
| | % of critical processes covered by traceability | Extent to which key business processes are covered by traceability (Supply Chain Coverage) |
| | % of traceable batches | Whether batch management of products can be carried out (Batch management effectiveness) |
| Data Quality and Accuracy | % of records with complete information | Data access convenience and information collection efficiency |
| | % of error-free records | Data accuracy |
| GDS – Global Data Standards | Global Data Standards - GDS adoption rate | Data interoperability by adopting common formats and standards including Product 2D code data carrier |
| ESG Credentials Implementation | % of products/processes with verified sustainability certification | Ensures reliability, authenticity, and transparency of ESG information by linking digital identity with ESG attributes |
| Regulatory Compliance and Audits | % of compliance with applicable traceability regulations | Measures compliance with legal and regulatory requirements for traceability |
| Business and Management Impact | Digital Traceability Adoption and Productivity Improvement | Enhance digital capabilities of enterprises; all data globally visible |
| | % increase in customer trust (measured through surveys) | Convenient access to ESG information enhances consumer trust |

b. **Indonesia**

| Category | KPI | Description |
|---|---|---|
| Product and Process Coverage | % of suppliers with traceability registries | Supply Chain Visibility |
| | % of critical processes covered by traceability | Supply Chain Visibility |
| Data Quality and Accuracy | % of records with complete information | |
| Response Time and Visibility | % of events visible in real time | Real-Time roasting, crystallization level and other processes monitoring |
| GDS – Global Data Standards | % of events visible in real time | |
| ESG Credentials Implementation | % of products/processes with verified sustainability certifications | |
| Regulatory Compliance and Audits | % of compliance with applicable traceability regulations | |
| Business and Management Impact | Digital Traceability Adoption and Productivity Improvement | Enhanced Inventory Management |

c. **Peru**

| Category | KPI | Description |
|---|---|---|
| Product and Process Coverage | % of suppliers with traceability registries | Supply Chain Visibility |
| | % of critical processes covered by traceability | Supply Chain Visibility |
| Data Quality and Accuracy | % of records with complete information | |
| | % of error-free records | Eliminate manual data transcription errors |
| GDS – Global Data Standards | Global Data Standards - GDS adoption rate | Standards use (percentage in the whole supply chain processes) |
| ESG Credentials Implementation | % of products/processes with verified sustainability certifications | —- |
| Regulatory Compliance and Audits | % of compliance with applicable traceability regulations | —- |
| Business and Management Impact | Digital Traceability Adoption and Productivity Improvement | Digitalization rate and productivity gain by reduction of operational times |

### 4.4.2. Simulation Exercises (Crisis or Audit)

Simulation exercises play a critical role in validating the robustness, responsiveness and reliability of the digital traceability and ESG credential systems implemented during the project. These exercises are designed to replicate real-world scenarios that supply chains may face—such as product recalls due to safety or compliance issues, ESG (Environmental, Social and Governance) audits by certification bodies or oversight interventions by government authorities.

The primary objective of these simulations is to assess how effectively the digital systems enable data retrieval, event tracking and verification of product information under pressure or in urgent contexts. For instance, in the case of a product recall, stakeholders should be able to trace the affected batch, identify its distribution path and notify relevant parties quickly using the event-based data stored in systems like EPCIS. Similarly, ESG validation scenarios test whether a company can provide digitally verifiable records—such as proof of origin, certifications or labor compliance—using standardized identifiers and Global Data Standards (GDS).

To enhance realism and learning outcomes, it is recommended that these exercises involve relevant public institutions (e.g., food safety authorities, customs agencies, others) or certification bodies (e.g., organic, fair trade or sustainability auditors). Their participation allows MSMEs to better understand real compliance expectations, regulatory procedures and documentation standards.

These simulations not only strengthen internal preparedness but also foster trust among trading partners and regulators, contributing to a more resilient and transparent supply chain ecosystem.

#### 4.4.3. Participatory Validation

This activity refers to the structured process of engaging all relevant stakeholders—particularly MSMEs, government representatives, certifying bodies and other supply chain actors—in testing and refining the proposed traceability and ESG data exchange solutions. Rather than being a top-down exercise, this phase emphasizes inclusivity and responsiveness to real-world conditions.

The process begins with the implementation of internal pilot tests in operational environments. These tests are designed to evaluate the usability, practicality and effectiveness of the designed processes, digital tools, data formats and communication flows across the supply chain. Crucially, these pilots should include participants from various levels of the chain, including producers, processors, exporters and regulatory or support institutions.

Following the pilot tests, structured feedback is collected from participants through surveys, interviews or group discussions. This feedback focuses on identifying what worked well, what challenges were found and what adjustments are necessary to make the system more efficient, inclusive and scalable. Special attention should be given to the capacity of MSMEs to comply with data input requirements, the clarity of formats and the ability to interoperate with external systems.

The goal of participatory validation is to ensure that the digital traceability and ESG systems are not only technically sound but also aligned with the practical needs, constraints and digital maturity of the users. This approach enhances user ownership, builds capacity through hands-on engagement and increases the likelihood of successful adoption and long-term sustainability.

### 4.5. PHASE 5 – SCALING AND SUSTAINABILITY

#### 4.5.1. Internal Scaling

This activity refers to the process of expanding the use of the digital traceability and ESG system within the same organization or economy. This includes replicating the platform and its methodologies across additional products, business units or supply chains, applying the lessons learned during the pilot phase to broader operations. The

goal is to secure internal adoption before moving on to cross-border or multi-economy integration, following the steps outlined below:

a. Replicate the Digital Platform System to other products or business units
b. Extend use to new markets and channels
c. Scale up pilot learnings to an industrial chain level.

### 4.5.2. Integration with External Systems

Refers to the process of connecting the digital traceability and ESG credential platform with external data sources and platforms—such as government certification databases, public traceability systems, APIs development to connect traceability platforms with reliable ESG credentials sources or existing Enterprise Resource Planning Software (ERP). This ensures interoperability, avoids data silos, enhances efficiency and strengthens the credibility and traceability of information throughout the supply chain.

### 4.5.3. Communication and Commercial Positioning

Is related to the strategic approach used to communicate the value of digital traceability and ESG credentials both internally within organizations and externally to markets, consumers and regulatory stakeholders. This includes defining clear messaging, visual identity and digital tools—such as 2D codes or digital product passports—that enable transparent and credible storytelling about product origin, sustainability practices and compliance. Effective communication and positioning are essential to build consumer trust, differentiate products in competitive markets and unlock new commercial opportunities, especially for MSMEs.

### 4.5.4. Government Participation and Interoperability

Governments play a fundamental role in promoting and implementing digital traceability and visibility systems across supply chains. Increasingly, they are investing in local or domestic platforms designed to support regulatory compliance, export facilitation, food safety, environmental oversight and ESG monitoring. However, for these platforms to be truly effective, they must be built upon global data standards—such as those developed by GS1 (e.g., Global Trade Item Number - GTIN, Global Location Number - GLN, Electronic Product Code Information System - EPCIS)—to ensure interoperability with private sector systems and with other economy's infrastructure.

Unfortunately, in many cases, governments opt to develop isolated or proprietary digital solutions that are not interoperable with international systems. This creates data silos, increases costs for businesses (especially MSMEs) and hinders cross-border trade. In contrast, the global trend is moving toward open, standardized approaches that enable seamless data exchange across systems, sectors, and economies.

By adopting and mandating the use of global data standards in their domestic or local platforms, governments can set the foundation for interoperability, ensure alignment with international markets, and foster digital transformation at scale. Their leadership is critical to driving harmonization across the ecosystem, reducing duplication of efforts, and supporting inclusive participation—particularly for small producers and MSMEs, who often face greater barriers to digital adoption. By ensuring their inclusion, governments not only strengthen competitiveness and compliance but also enable equitable access to global markets and sustainable growth.

### 4.5.5. Risk Management

The following table presents a list of risks, categorized by type, including a description of each risk and the corresponding mitigation activities. This analysis is the result of the execution of the pilot projects across the three participating economies. Although all pilots were conducted with MSMEs, the project encountered a wide diversity of

companies, particularly in terms of their level of digital maturity. Some enterprises operated almost entirely with manual processes at the start of the project, while others had partially automated systems supported by internal software.

This diversity provided a valuable testing ground that demonstrated the adaptability of both the proposed methodology and the recommended Global Data Standards. Despite the initial differences in digital capabilities, all participating companies successfully implemented traceability registries and ESG credentials. This outcome confirms not only the feasibility of the approach but also its scalability across different contexts and levels of technological readiness.

| Type of Risk | Risk & Description | Economies Affected | Mitigation Activities |
|---|---|---|---|
| Technical / Digitalization | Limited digital capabilities of MSMEs; many processes are still manual (Excel or paper records), hindering adoption of traceability platforms and limited data accuracy and efficiency. | Partially People's Republic of China (Silk, Down Coat); Indonesia (Coffee, Palm Sugar) and Peru (Coffee) | Provide intensive training, hands-on workshops and ongoing mentoring, enabling MSMEs to confidently adopt digital solutions in their business processes (basic databases management and integration with internal systems facilitating more structured and reliable documentation of production and operational processes. Phased implementation (manual → semi-digital → full digital), deploy user-friendly mobile apps, templates for data recording and ensure ongoing technical support. |
| | Suboptimal implementation of Standard Operating Procedures (SOPs): Some MSMEs had not fully implemented their internal SOPs, which could impact consistency and product quality. | Indonesia | Include practical training sessions on SOP standardization, on-site coaching, and regular compliance checks to reinforce proper operational procedures. |
| Standards & Interoperability | Use of heterogeneous systems (ERP, QR codes, local platforms like SNIFFS for forest and wildlife information system in Peru), in some cases without full alignment to GS1 GDS, creating interoperability issues. | All economies | Promote GS1 Global Data Standards (GTIN, GLN, 2D Digital Link), develop APIs/interfaces to connect existing systems, run pilot tests for data exchange and interoperability. |
| Data Reliability, Authenticity and Confidentiality | ESG credentials and traceability data often stored manually (PDF, paper) without direct validation from certifying bodies, raising risks of incomplete or unverifiable data. | All economies | Advocate integration with certifying entities (via APIs), conduct random audits, require digital uploads of certificates linked to GLN/GTIN. |
| | MSMEs are concerned that traceability could expose sensitive business information. | All economies | Make sure platform does not share or show any sensitive data. |
| Regulatory / Policy Alignment | Differences between domestic regulations (e.g., SERFOR/SNIFFS in Peru, EU sustainability requirements in textiles) may delay cross-border interoperability. | Mainly People's Republic of China and Peru Potentially all | Align pilot recommendations with government agencies, encourage adoption of GS1-compliant 2D codes in public systems, foster public–private dialogue. |

| Type of Risk | Risk & Description | Economies Affected | Mitigation Activities |
|---|---|---|---|
| Operational / Scheduling / MSME Capacity & Commitment | Limited resources (human, financial, technological) among MSMEs to sustain traceability systems beyond pilot funding. | Partially People's Republic of China (OEM factories); Indonesia and Peru (MSMEs) | Strengthen capacity building, link MSMEs with associations/cooperatives, explore subsidies or donor support, implement low-cost scalable solutions. |
| | Incorrect selection of MSMEs (e.g., those without minimum capabilities or motivation), limiting the success of the pilots. | All economies (critical in Indonesia & Peru) | Establish clear selection criteria; validate candidates with local associations; provide pre-engagement orientation. Conduct on-field research together with the local market surveillance authority, promoting the pilot's influence and benefit to encourage MSMEs to participate. |
| | Pilot execution dates not aligned with company availability or production cycles, creating delays or incomplete results. | All economies | Early scheduling; coordinate with companies' calendars; maintain flexibility in pilot timelines. |
| | Lack of commitment or alignment among participating economies, which may delay or complicate pilots' execution and coordination. | All economies | Maintain continuous communication with focal points; ensure early agreement on scope, roles and responsibilities; adequate pilot stakeholders management in each economy; APEC oversight. |
| Cultural / Adoption Resistance | MSMEs and suppliers may perceive digital traceability as additional workload or cost, slowing adoption. | All economies | Awareness campaigns highlighting market access benefits, peer-to-peer learning, incentives for early adopters, simplified onboarding. |
| Infrastructure / Connectivity | Rural areas (coffee regions in Peru and Indonesia) face unstable internet access, limiting real-time data capture. | Indonesia; Peru | Enable offline data capture with later synchronization, provide mobile devices pre-configured with traceability apps, advocate for improved connectivity. |
| Sustainability / Continuity | Risk of pilots not being scaled up after APEC project ends due to lack of funding, ownership or institutionalization. | All economies | Develop sustainability roadmap, secure buy-in from local chambers/governments, ensure business models that show ROI for MSMEs. |

### 4.6. ROADMAP SUMMARIZING TABLE

Below we have included a table summarizing the phases outlined in the roadmap, their respective activities, responsible parties, and estimated timelines based on the experience demonstrated in the pilots, along with final notes for specific activities where applicable.

| Phase | Phase Name | Activity | Key Stakeholders / Responsible Parties | Outputs / Deliverables | Estimated Duration | Notes / Additional Considerations |
|---|---|---|---|---|---|---|
| **PHASE 1** | **Preparation and Assessment** | Conduct diagnostics (12-question baseline) | MSMEs, Local GS1 Offices, Project Team, Local Facilitators and Authorities | Baseline diagnostic report | 1 month | Critical to identify digital maturity and training needs for MSMEs. |
| | | Define Objectives and Scope | | Defined project objectives & scope | | Will define the KPIs to be measured |
| | | Assessment of Internal Capabilities | | Internal capacity assessment | | |
| | | Identification of Key Stakeholders | | Stakeholder map | | |
| **PHASE 2** | **Identification and Planning** | Identification of Traceable Items and Assignment of GDS Identifiers (GTIN, GLN, 2D Codes Digital Link) | MSMEs, Local GS1 offices, IT/Tech Providers & Staff | Assigned identifiers | 1 month | Platform must ensure interoperability and use GDS |
| | | Process & Data Mapping (CTEs/KDEs) | | Process maps | | |
| | | Identification/Selection/Adaptation of a Digital Platform or another registry method, includes definition of responsibilities and training materials | | Platform selection and setup | | |
| | | | | Training plan | | For building capabilities |
| **PHASE 3** | **Digital Registration and Documentation** | Implementation of Digital Record Keeping including Training plan, Assign users roles, Input traceability and ESG data, Link ESG certificates | MSMEs, Local GS1 Offices, IT staff, Certifying bodies. | Configured platform | 3 months | |
| | | | | Training plan | | |
| | | | | Users' role matrix | | |
| | | | | Digital records uploaded | | |
| | | | | Integrated ESG certificates | | |
| | | Generation of 2D Codes with Digital Link | | 2D codes applied | | |

| Phase | Phase Name | Activity | Key Stakeholders / Responsible Parties | Outputs / Deliverables | Estimated Duration | Notes / Additional Considerations |
|---|---|---|---|---|---|---|
| **PHASE 4** | **Monitoring, Simulation and Validation** | Definition of KPIs (Key Performance Indicators) | MSMEs | KPI dashboard | 1 month | Selection of KPIs aligned with Section 3.2.8. |
| | | Run Exercises (Crisis or Audit) | MSMEs, Regulators, Certifiers | Simulation reports | | |
| | | Participatory validation | MSMEs, Governments, Certifiers | Validation feedback | | Participatory approach builds trust. |
| **PHASE 5** | **Scaling and Sustainability** | Internal Scaling | MSMEs | Internal scale-up plan | Ongoing Process | Government support critical. |
| | | Integration with external systems | MSMEs, Governments, Local GS1 Offices | Integrated systems | | |
| | | Communication and Commercial Positioning | MSMEs, Industry Associations | Communication materials | | |
| | | Governments participation and Interoperability | MSMEs, Governments, Industry Associations | Sustainability roadmap | | Foundation for cross-border adoption. |
| | | Risk Management | | Mitigation Activities Plan | | |

# 5. CASE STUDIES

## 5.1. PEOPLE'S REPUBLIC OF CHINA SILK SUPPLY CHAIN

### 5.1.1. SECTION 1

a. **Business Case Title:**
   Implementation of traceability records and ESG (Environmental, Social and Governance) credentials to improve the transparency of the silk supply chain.
b. **Economy of execution:** People's Republic of China
c. **Industry member:** Jiangsu Huajia Silk Co., LTD

### 5.1.2. SECTION 2 - Introduction

Huajia is a textile company located in Shengze Town, Jiangsu Province, an area renowned for its concentration of silk industries. The company participates in various stages of the value chain and has subsidiaries such as Guangxi Yingchun Silk Co. and Yunnan Qujing Huajia Silkworm Planting Co. Its practices include traceability, recording information from the receipt of raw materials, inspections, and production processes to distribution logistics. The company also holds internationally recognized sustainability and quality certifications such as OEKO-TEX, GRS, ISO, GOTS, and organic product certification in People's Republic of China, which underpin its commitment to health, the environment, and market trust.

The objective of its participation in the APEC project was to accelerate the digitalization and dissemination of reliable ESG credentials within the textile value chain, in response to growing demands such as the European Union's Digital Product Passport and global textile sustainability strategies. By using global data standards and visibility platforms, the project sought to integrate traceability and sustainability information, facilitating transparent exchange among SMEs in the sector and promoting trust and competitiveness among end consumers.

### 5.1.3. SECTION 3 - Blue Block[8]

a. From heritage craft to global supply chains—digitalization powers People's Republic of China's sustainable fashion.
b. Global Data Standards (GDS) Adoption: Implementing GS1 standards enables data interoperability, streamlines disclosure processes, reduces compliance costs and facilitates trade for Chinese textile enterprises.
c. Enhanced ESG Credentials Credibility: Binding ESG credentials (OEKO-TEX certifications for silk products, GRS, ISO 9001/14001, carbon footprint reports) to global standard identification. Pioneered exploring digital solutions include collaborating with People's Republic of China Qualification Center (CQC) for certified quality management system data exchange and partnering with "China Textile and Apparel Council (CNTAC)", Social Responsibility Office for credential disclosure.
d. Green Transformation: End-to-end visibility from fiber to product aligns with global green rules and sharpens People's Republic of China textile industry's edge in green markets.
e. Through the pilot platform, supply chain data has evolved from initially capturing only end-product information to encompassing full supply chain visibility, involving supply chain data coverage of more than 90%.
f. The pilot has also enabled supply chain traceability through batch-level management, with reduced resource waste in supply chain logistics by 15%.

[8] Visual box, typically in blue, used to highlight and summarize key information—such as main outcomes, strategic insights and recommendations.

### 5.1.4. SECTION 4 – Silk Supply Chain Development

Huajia Silk faced multiple challenges. ESG credentials lacked verifiability due to fragmented digital and physical documentations with no centralized management; supply chain opacity persisted as isolated data from sericulture, filature, weaving and garment sewing prevented comprehensive traceability access for consumers, regulators and business partners; mounting international compliance pressure—particularly from the EU Digital Product Passport and Sustainable Textiles Strategy—strained its export operations; while subsidiaries cover all production stages, information across nodes has not been effectively linked, leaving space for improvement in full-chain traceability and collaborative efficiency.

As one member company of GS1 China, Jiangsu Huajia Silk Co., Ltd. has assigned Global Trade Item Numbers (GTIN) to 202 apparel and textile products. Leveraging the APEC project and Global Data Standards, the company enhanced supply chain transparency and ESG digitization by assigning Global Location Numbers (GLN) to key supply chain nodes (e.g., Guangxi Yingchun Silk, JiangSu Huajia Holding, etc.); applying unique identification product numbers to silk, fabrics and finished garments; and registering product, corporate, certification and traceability data on the traceability platform. The GS1-compliant 2D codes with Digital Link are generated for printing on product hangtags and care labels, enabling instant access to verify ESG credentials and traceability information.

a. **Collecting data**

Huajia is in Shengze Town, Wujiang District, Suzhou City, Jiangsu Province, in the silk industry density area. Huajia holds shares in some enterprises within the supply chain. Its subsidiaries include Guangxi Yingchun Silk Co., Yunnan Qujing Huajia and Silkworm Planting Co., among others. In response to market requirement, Huajia already holds a lot of credentials, stored in the form of electronic as well as physical documents. Data silos persist due to non-interoperable systems across supply chain enterprises, impeding critical information sharing. As a result, Huajia is keen to establish a standardized ESG data recording and management system based on the global identification, to integrate the up and down stream digital data and make them more reliable and accessible to the customers, consumers and regulators.

Throughout the entire supply chain process from sericulture to dispatch the final product, the silk pajamas to customers, the ESG information will be sourced from the certifications and reports already in possession of the companies and will be digitally integrated onto the traceability platform. The strategies are centered around establishing an interoperable environment for data sharing among MSMEs, drawing valuable insights and lessons from the collaborative efforts with apparel manufacturers and related stakeholders throughout this project.

Huajia silk supply chain has total five processes, including sericulture, filature, weaving, garment sewing and logistics, which you can see in detail in Figure 8:


*Figure 8 – Huajia silk textile supply chain processes. Source: Own Elaboration*

As part of the designed methodology, this stage was to identify two key components for building the process maps: Critical Tracking/Monitoring Events (CTEs) and Key Data Elements (KDEs). Together with the definition of the Global Data Standards (GDS) and the data repository, these will make it possible to properly customize the traceability platform that will support the implementation of the pilot projects. Figure 9 illustrates the finalized mapping of the Huajia Silk supply chain process, using GTIN and Batch number to link the data of each supply chain node.

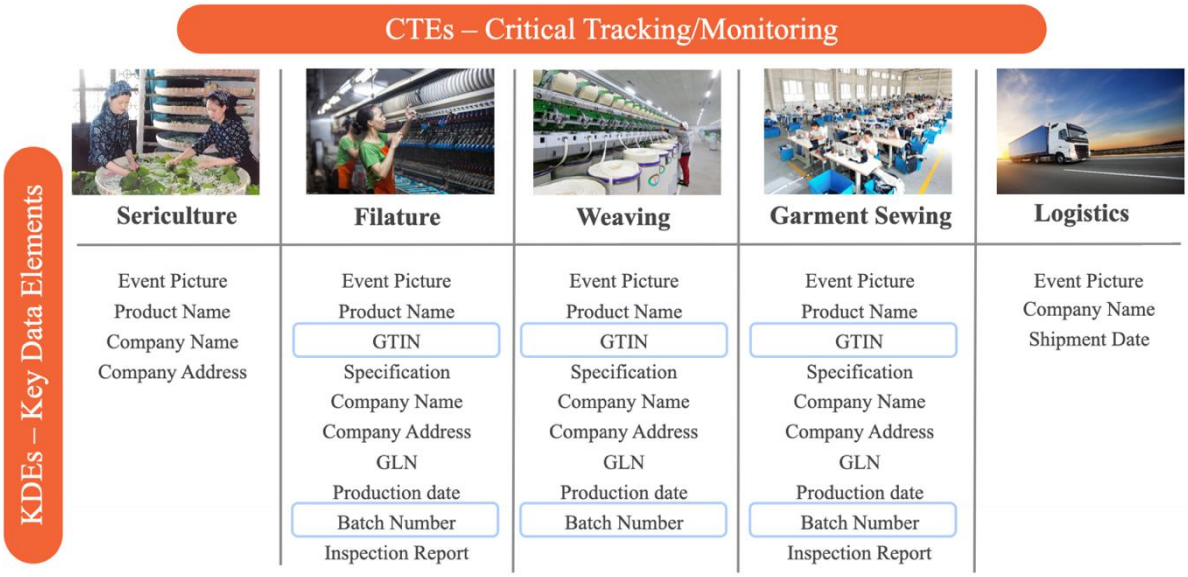



*Figure 9 - Mapping Process for Huajia Silk Supply Chain. Source: Own Elaboration*

b. **Filling the information**

This project uses the current GS1 China Product Information Service Platform, with added function on traceability platform. Figure 10 illustrates an example of traceability information fill out in the platform. Following is the main steps for information filling.

b.1. Fill in product Information: basic information can be automatically synchronized to the GS1 China Product Information Service Platform, publicly visible to consumers. And the product Information can be filled in Chinese and English at the same time.

b.2. Fill in company and Brand Information: the brand information could also include company promotion image and video.

b.3. For the ESG Certificate, the platform provides two methods of ESG certificate upload:
- Option 1: ESG certificate is linked with company GLN or product GTIN, which could be uploaded individually by the upstream company, therefore all the ESG certificates across the supply chain can be associated with the final product using GTIN or GLN.
- Option 2: ESG certificate can be uploaded altogether by the brand owner.

b.4. As one highlight of this project, some certificate can link directly to the Certification bodies (CQC, etc.) database to enhance reliability and authenticity of the certificate.

b.5. Traceability Information: same as ESG certificate, traceability information could be uploaded by each supply chain company accordingly, then synchronize to the final product by GTIN and batch number across the whole supply chain.

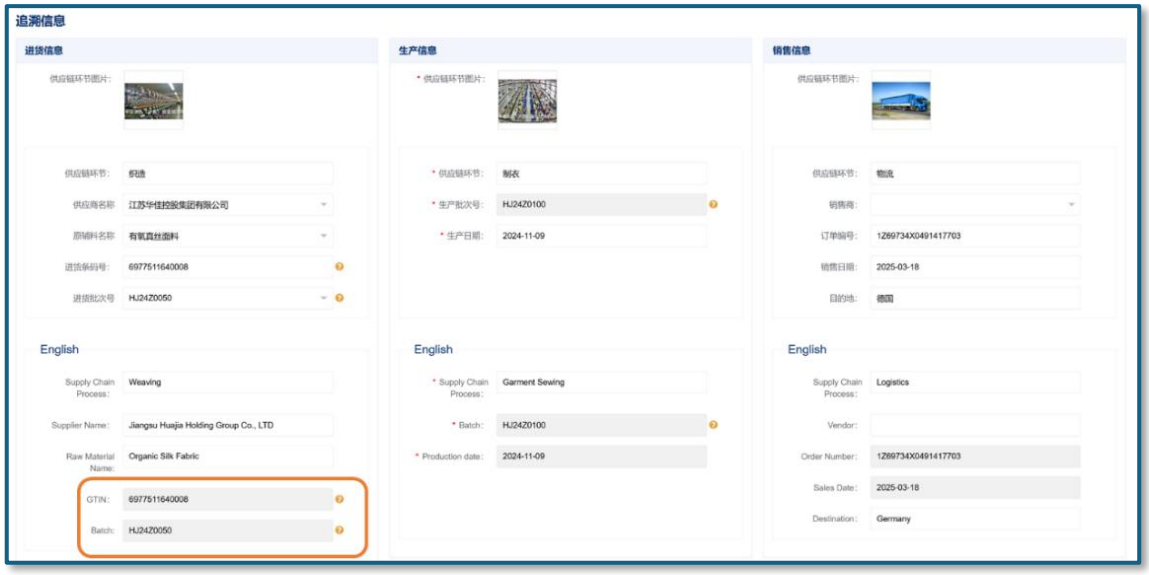



*Figure 10 – Traceability information fill out. Source: Own Elaboration*

b.6. Generate 2D Code: once the product information upload finished, GS1 Digital Link standard 2D code will be automatically generated according to the GTIN and Batch Number, which you can see in the Figure 11.

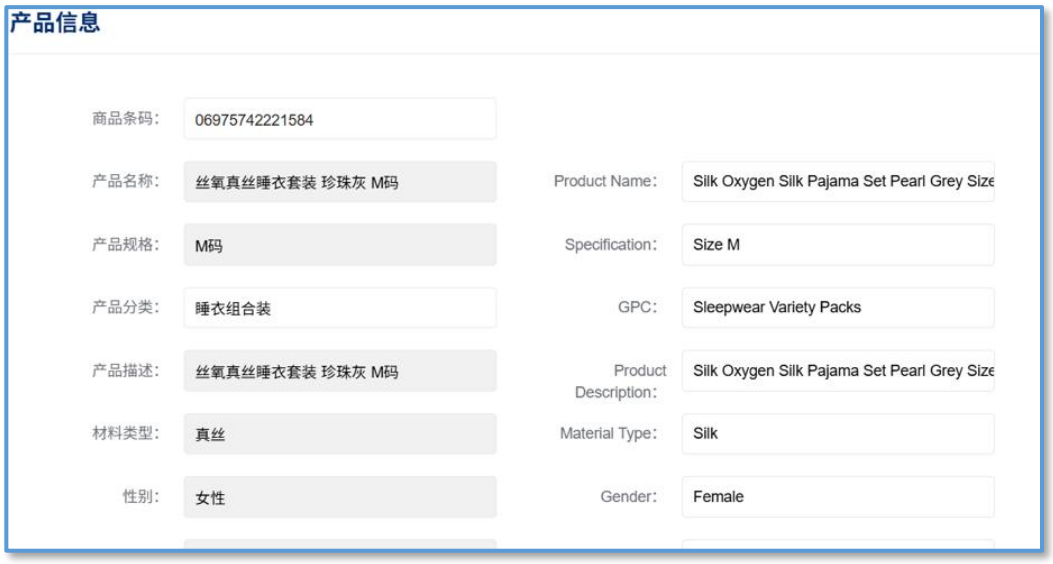



*Figure 11 – 2D code generation. Source: Own Elaboration*

In Figure 12, information synchronizes to GS1 Global Registry Platform[9]: the product master data and ESG information can be accessed from GS1 Global Registry Platform to make the data globally visible.


*Figure 12 – Global Registry Platform Product information (Source: GS1 Global Registry Platform). Source: Own Elaboration*

[9] *The GS1 Global Registry Platform is a centralized global system managed by GS1 that enables the registration, validation, and sharing of standardized product and location data (such as GTINs and GLNs). It facilitates interoperability and data synchronization across supply chains worldwide by ensuring trusted, verified data is accessible to authorized stakeholders. This platform supports traceability, transparency, and regulatory compliance in global trade.*

**c. Project outcome**

In Figure 13, you can see photos of the 2D code on the final product ready for export.

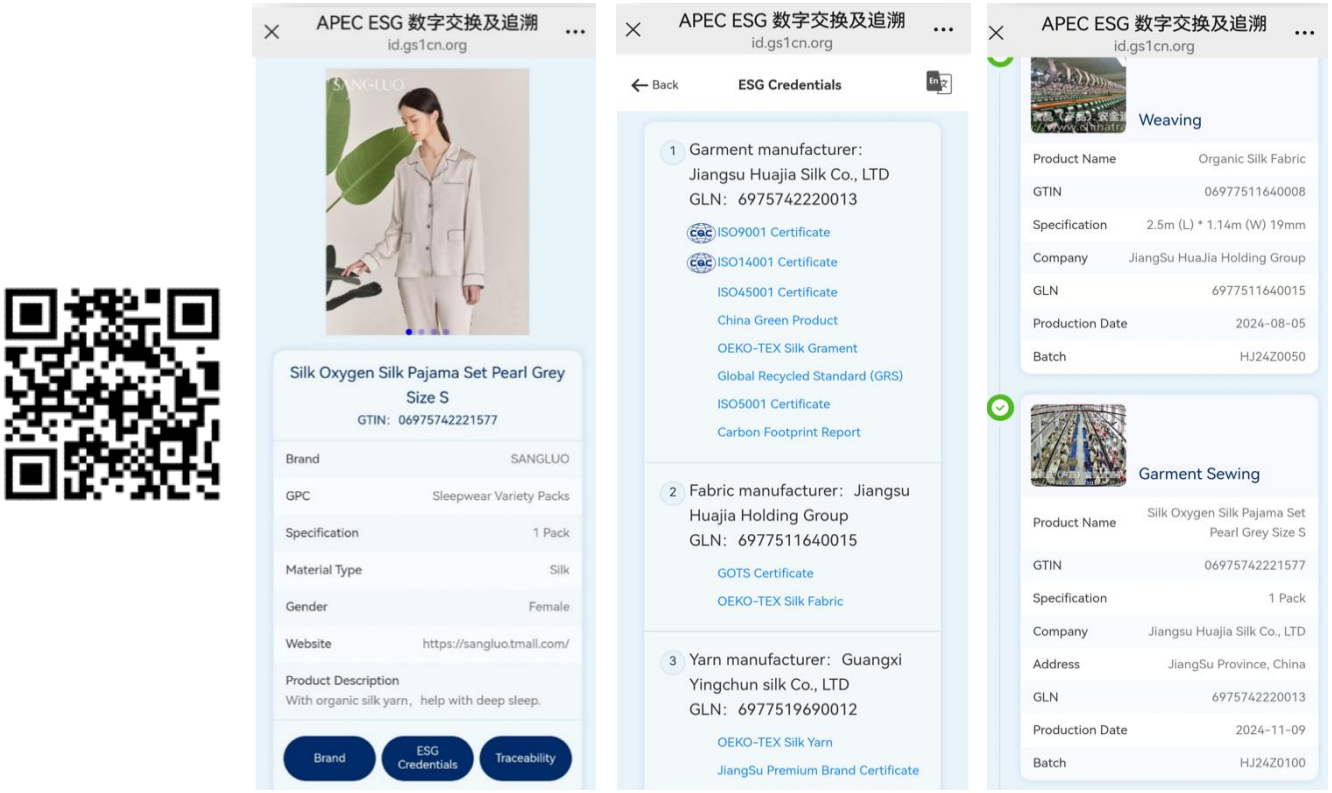



*Figure 13 – Huajia Sangluo Silk Pajama product, Hangtag and care label. Source: Own Elaboration*

Detailed information could be accessed by scanning the QR code on the hangtag or care label as you can see in Figure 14.

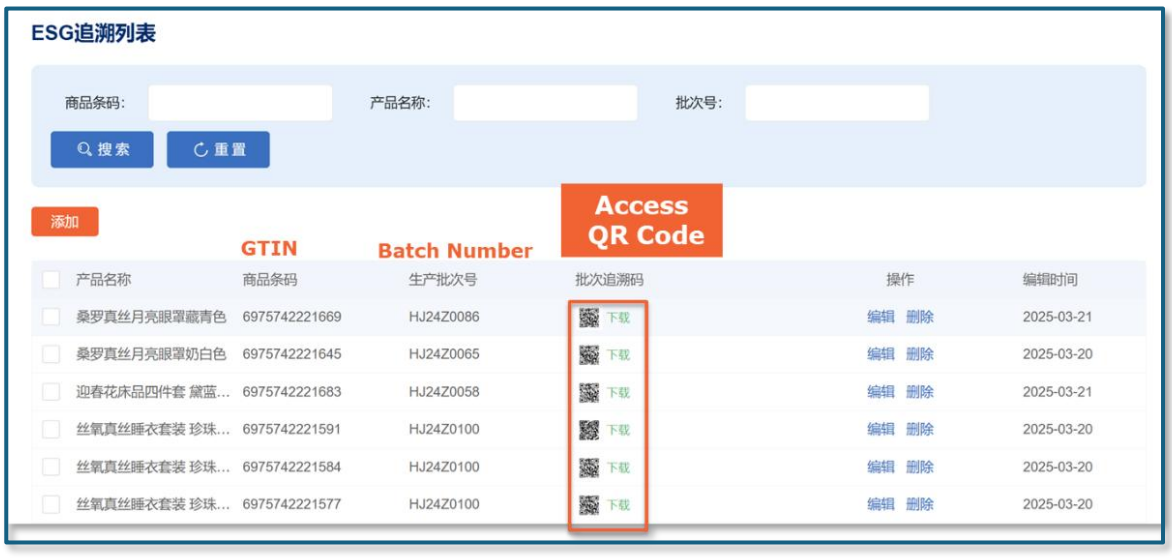



*Figure 14 – Platform interface with product information, brand information, traceability and ESG information. Source: Own Elaboration*

d. **Key Performance Indicators - KPIs**

The following Key Performance Indicators (KPIs) have been identified to ensure supply chain transparency and facilitate international trade. They are grouped into six categories, as defined in the roadmap and derived from the execution of the pilots.

Before Pilot: □ After pilot: ■

| KPI CATEGORY | KPI | NONE (ZERO) | FOUNDATION | INTERMEDIATE | PROFICIENT | EXPERT |
|---|---|---|---|---|---|---|
| **Product and Process Coverage** | % of Suppliers with Traceability Registries (Supply Chain Coverage Rate) | | □ | | ■ | |
| | % of critical processes covered by traceability (Supply Chain Coverage Rate) | | □ | | ■ | |
| | % of Traceable Batches (Batch management effectiveness) | | □ | | ■ | |
| **Data Quality and Accuracy** | % of error-free records (Data Accuracy) | | □ | | ■ | |
| | % of Records with Complete Information (Data access convenience and Information Collection Efficiency) | | □ | | | ■ |
| **GDS - Global Data Standards** | Global Data Standards - GDS adoption rate (Data Interoperability) | □ | | | | ■ |
| **ESG Credentials Implementation** | % of Products/Processes with verified sustainability certifications (Information Reliability) | □ | | | ■ | |
| | % of Products/Processes with verified sustainability certifications (Access convenience and Information collection efficiency) | | □ | | | ■ |

| KPI CATEGORY | KPI | NONE (ZERO) | FOUNDATION | INTERMEDIATE | PROFICIENT | EXPERT |
|---|---|---|---|---|---|---|
| **Regulatory Compliance and Audits** | % of compliance with applicable traceability regulations (Compliance Requirement) | | | □ | ■ | |
| **Business and Management Impact** | Digital Traceability Adoption and Productivity Improvement (Digital Capabilities and Globally Accessible) | | □ | | ■ | |
| | % increase in customer trust, measured through surveys (Consumer Access Ability) | □ | | | ■ | |

#### 5.1.5. SECTION 5 - Conclusions

This project addresses challenges in the textile industry such as long supply chains, diverse raw material sources, and complex domestic and international ESG certification requirements by innovatively developing a solution centered on Global Data Standards (GDS). Through applying GTIN for unique product identification and GLN for locating supply chain nodes, it associates compliance information like carbon footprints and Global Recycle Standard (GRS)—covering processes from planting/breeding, weaving, and processing to garment production—with identifiers. Leveraging technologies such as 2D codes and Digital Link, it integrates scattered supply chain and certification information to form a traceable "digital passport."

The project effectively breaks down information silos, enabling the connection of ESG data from raw materials to finished products. It also provides one-stop access to product certification information, offering an effective technical tool for enterprises to efficiently respond to international regulations like the EU Digital Product Passport and reduce compliance costs. Implementation of this project enhances the digital capabilities of MSMEs, improves the credibility and transparency of international trade. It provides a replicable Chinese model for promoting sustainable development and trade facilitation in industries across APEC economies.

### 5.2. INDONESIAN PALM SUGAR SUPPLY CHAIN

#### 5.2.1. SECTION 1

a. **Business Case Title:**
   Implementation of traceability records and ESG (Environmental, Social and Governance) credentials to improve the transparency of the palm sugar supply chain
b. **Economy of execution:** Indonesia
c. **Industry member:** CV Temon Agro Lestari

### 5.2.2. SECTION 2 - Introduction

CV. Temon Agro Lestari is a company dedicated to processing organic palm sugar in Pacitan, East Java, Indonesia. Its monthly production ranges between 10 and 20 tons, adapting to market demand, and offers products such as molded, liquid, and granulated palm sugar. The company works closely with local aren (palm) farmers, empowering and training them, promoting community employment and a sustainable business model that contributes to the preservation of natural ecosystems. It also holds HALAL, HACCP, and BPOM laboratory testing certifications, which support the quality and safety of its products.

The objective of its participation in the APEC project was to incorporate traceability practices and the digitalization of ESG credentials into the palm sugar value chain, improving trust in its products in international markets. This project sought to standardize production processes through SOPs, ensure compliance with global sustainability standards, and strengthen the company's competitiveness. At the same time, the initiative demonstrates how data digitization can benefit agricultural MSMEs in rural areas, contributing to local economic development and the preservation of traditional production practices.

### 5.2.3. SECTION 3 - Blue Block[10]

a. 100% Global Data Standards (GDS) compliance
b. 100% Critical Processes covered by Traceability
c. Certification obtained: Food Product for Industry, Good Manufacturing Practices, Halal Certificate, Hazzard Analysis and Critical Control Points (HACCP), Free Pesticide Certificate, Certificate of Compliance for Processed Food Commitments and Business License.
d. CV. Temon Agro Lestari won the top deal award at the BRI MSMEs EXPO. They are representing the city of Pacitan on a trade mission to Japan.

### 5.2.4. SECTION 4 – Palm Sugar Supply Chain Development

CV. Temon Agro Lestari is committed to strengthening traceability and ESG practices to meet international market requirements. While ESG certifications are in place, traceability for palm sugar is still recorded manually. The data has not yet to be digitized or integrated into a centralized system.

CV. Temon Agro Lestari is a registered member of GS1 Indonesia and has implemented Global Trade Item Number (GTIN) in EAN-13 format for its Granulated Palm Sugar primary packaging, as well as Global Location Numbers (GLN) to identify its production, packing, and distribution sites.

As part of this project, CV. Temon Agro Lestari will receive support in the implementation of 2D codes on the primary packaging of Granulated Palm Sugar.
This enables consumers to access detailed product information, including the production process—from harvesting to final packaging—as well as ESG certifications issued by the relevant government authorities.

a. **Collecting data**

Farmers harvest nira (palm sap) from sugar palm trees, which is then cooked and poured into bowl-shaped molds before being delivered to *Temon Agro Lestari CV* for further processing. Nira serves as the raw material for palm sugar production. The processing stages include raw material selection, boiling, oven-drying, refining,

[10] Visual box, typically in blue, used to highlight and summarize key information—such as main outcomes, strategic insights and recommendations.

labeling, sealing, and packaging. Once processed, the palm sugar is sorted by color density into two grades: Grade A, used for granulated palm sugar, and Grade B, used for liquid palm sugar. After final packaging, the products are ready for shipment to buyers.

A detailed explanation is shown in Figure 15.

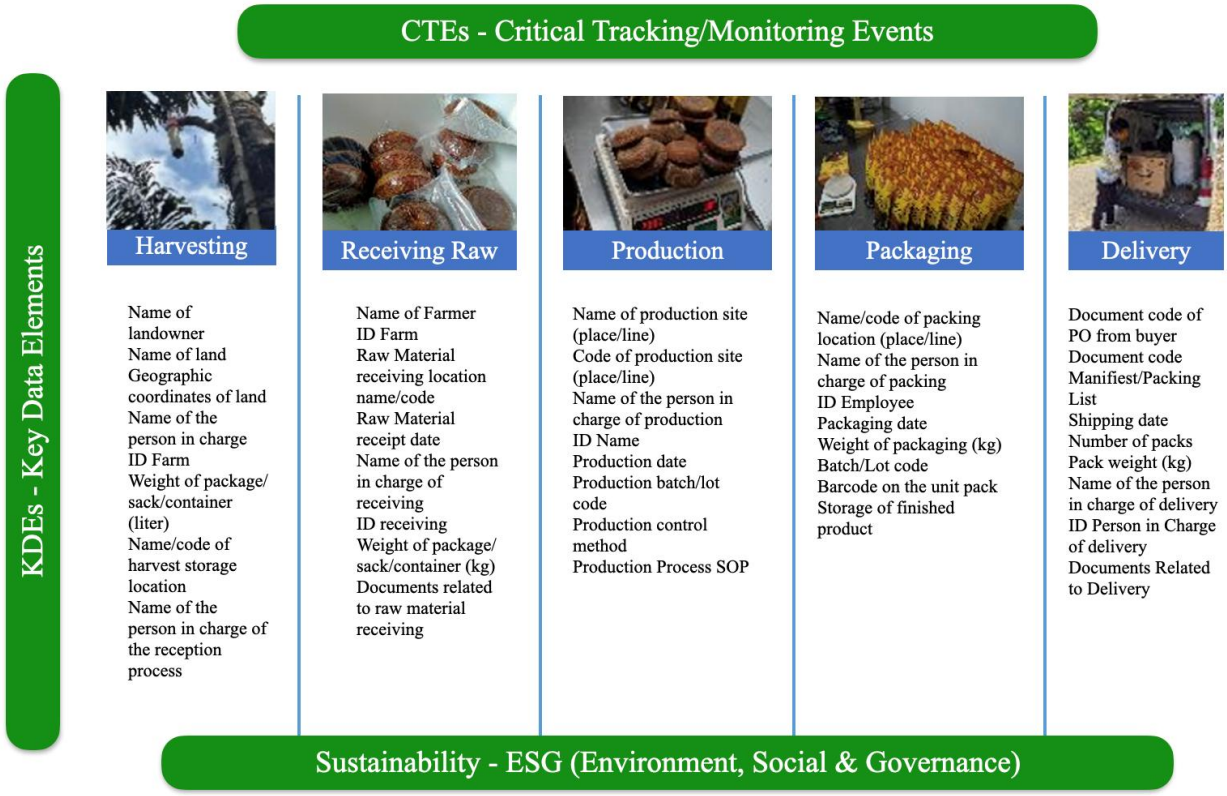



*Figure 15 – Palm Sugar Supply Chain Processes – Source: Own Elaboration*

As part of the designed methodology, this stage was to identify two key components for building the process maps: Critical Tracking/Monitoring Events (CTEs) and Key Data Elements (KDEs). Together with the definition of the Global Data Standards (GDS) and the data repository, these will make it possible to properly customize the traceability platform that will support the implementation of the pilot projects. Figure 16 shows information and documentation on Critical Tracking Events (CTEs) and Key Data Elements (KDEs) were collected and used to develop process maps, which reflect the key activities across the supply chain, including harvesting, raw material acceptance, production, sealing and packaging, and distribution to retail.

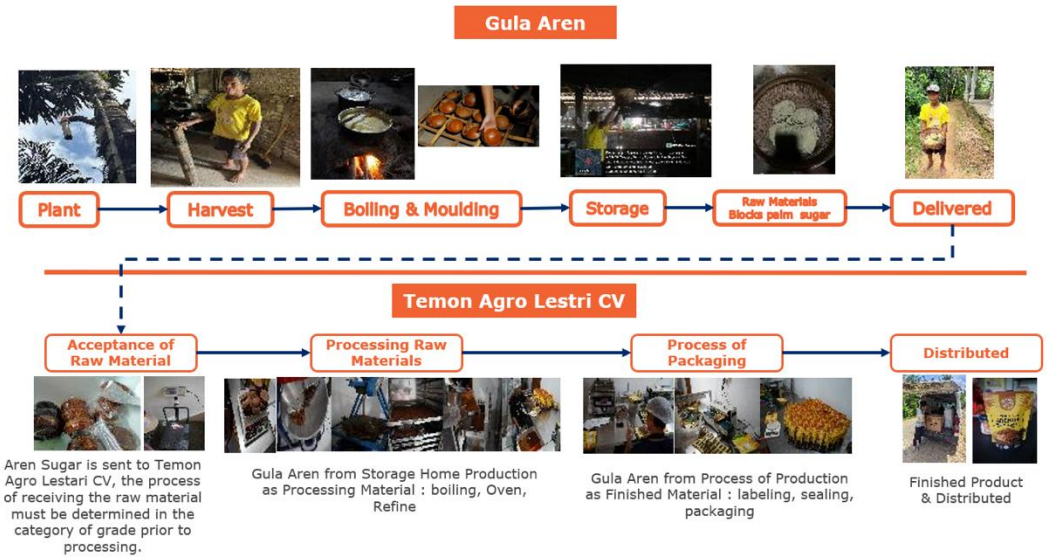



*Figure 16 - Mapping Process for Palm Sugar Supply Chain. Source: Own Elaboration*

b. **Filling the information**

For the ESG implementation, GS1 Indonesia and CV. Since Temon Agro Lestari are utilizing an application developed by the GS1 Peru team, as the company or GS1 Indonesia does not currently have its own supporting system in place.

The platform supports two user roles: (1) the Administrator role, responsible for platform configuration and user access management; and (2) the Data Logger role, designated for inputting traceability data and accessing the application's query module to verify synchronization processes.

A key feature of the platform is its ability to configure Critical Tracking Events (CTEs) and Key Data Elements (KDEs) at each stage of the supply chain, enabling consistent and structured data capture. Additional functionalities include supply chain actor management, input and visualization of traceability data, audit trail generation, and real-time access to product information via 2D code scanning—features that enhance transparency, traceability and overall operational efficiency.

*Figure 17 – Training process through GS1 Indonesia local facilitator. Own Elaboration*

c. **Project outcome**

By utilizing the 2D GS1 Digital Link, this implementation enables real-time access to traceability and ESG information via mobile scanning, thereby supporting MSMEs and promoting transparency using Global Data Standards (GDS).

This initiative adds value to the product by engaging all stakeholders across the supply chain. A product tag incorporating the 2D code is available and can be scanned using mobile device. Production batch No.: PNI00108022024 was performed on-site at the processing plant and can be verified at the following link: ***https://apec-trace-tal.com/tal/01/08991004099508/10/PNI00108022024***

Figures 18, 19 and 20 shows details of the Palm Sugar final product with 2D code incorporated, Platform interface with product, brand, traceability and ESG information and Platform traceability supply chain.


*Figure 18 – Palm Sugar product with 2D code. Source: Own Elaboration*

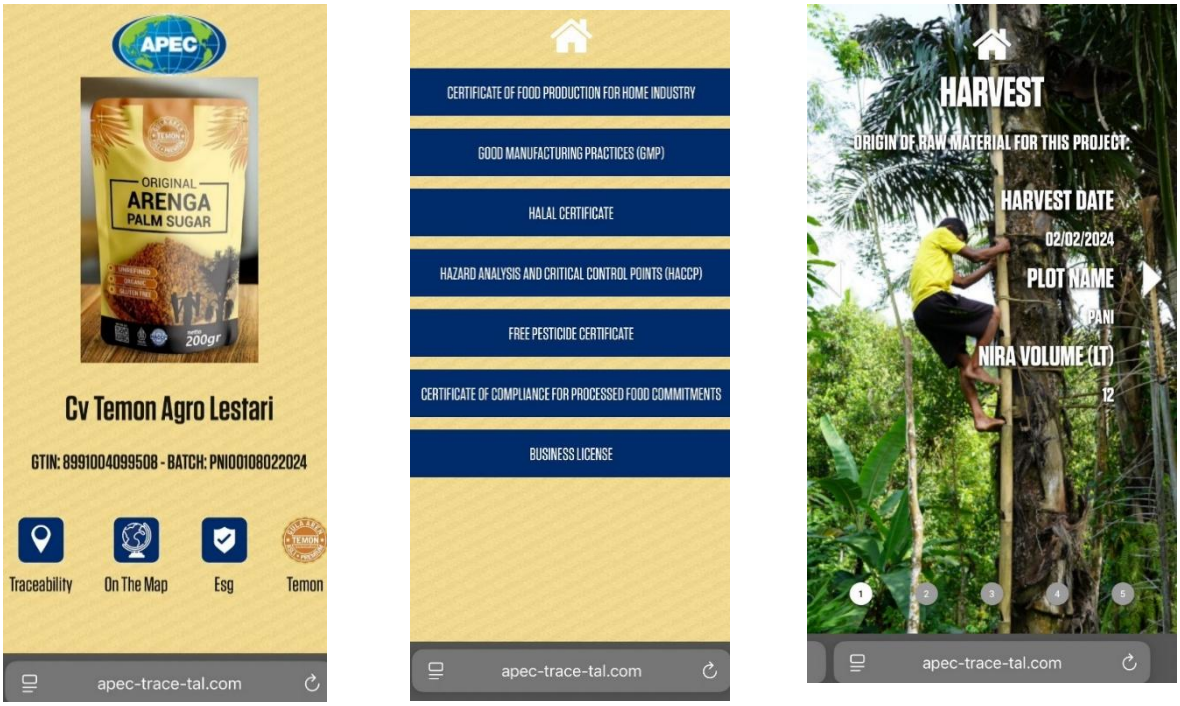



*Figure 19 – Web App interface with product, traceability and ESG information. Source: Own Elaboration*

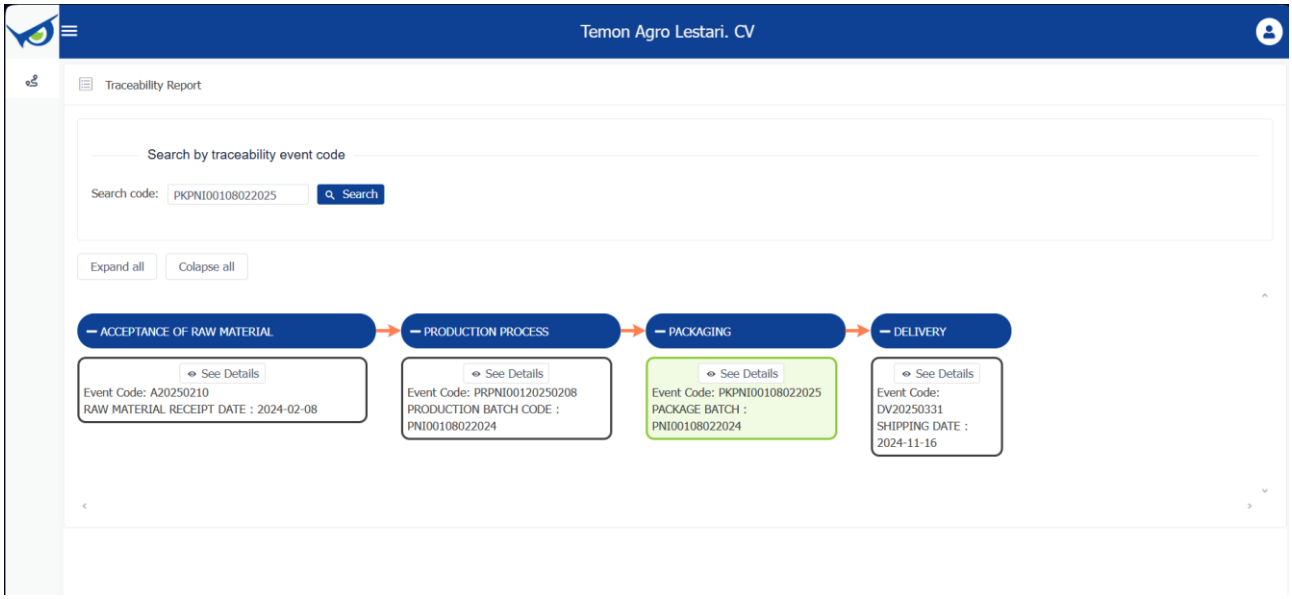



*Figure 20 – Platform interface with traceability registries. Source: Own Elaboration*

d. **Key Performance Indicators - KPIs**
The following Key Performance Indicators (KPIs) have been identified to ensure supply chain transparency and facilitate international trade. They are grouped into six categories, as defined in the roadmap and derived from the execution of the pilots.

Before Pilot: □ After pilot: ■

| KPI CATEGORY | KPI | NONE (ZERO) | FOUNDATION | INTERMEDIATE | PROFICIENT | EXPERT |
|---|---|---|---|---|---|---|
| **Product and Process Coverage** | % of Suppliers with Traceability Registries (Supply Chain Visibility) | | □ | | | ■ |
| | % of critical processes covered by traceability (Supply Chain Visibility) | | □ | | | ■ |
| **Data Quality and Accuracy** | % of Records with Complete Information | □ | | | ■ | |
| **Response Time and Visibility** | % of events visible in real time (Roasting and Crystallization Processes Real-Time Monitoring) | □ | | | ■ | |
| **GDS - Global Data Standards** | Global Data Standards - GDS adoption rate | | □ | | | ■ |
| **ESG Credentials Implementation** | % of Products/Processes with verified sustainability certifications | □ | | | ■ | |

| KPI CATEGORY | KPI | NONE (ZERO) | FOUNDATION | INTERMEDIATE | PROFICIENT | EXPERT |
|---|---|---|---|---|---|---|
| **Regulatory Compliance and Audits** | % of compliance with applicable traceability regulations | □ | | | ■ | |
| **Business and Management Impact** | Digital Traceability Adoption and Productivity Improvement (Enhanced Inventory Management) | | □ | | ■ | |

#### 5.2.5. SECTION 5 - Conclusions

The implementation of GS1 Digital Link enhances product transparency by enabling consumers and stakeholders to instantly access comprehensive information, including ESG credentials and production processes, thereby strengthening accountability across the supply chain. By presenting verified ESG data through a 2D code, it also builds trust and credibility among consumers and buyers, particularly in international markets where sustainability and ethical sourcing are key considerations. In addition, the use of GS1 identifiers such as GTIN (Global Trade Item Number) and GLN (Global Location Number) supports MSMEs in complying with global data standards and aligning with international regulations and buyer expectations on traceability, sustainability, and ethical production. Ultimately, this implementation empowers MSMEs and smallholder farmers by increasing their visibility within the global supply chain, allowing them to demonstrate their commitment to responsible practices and improving their competitiveness in both domestic and international markets.

### 5.3. PERUVIAN COFFEE SUPPLY CHAIN

#### 5.3.1. SECTION 1

a. **Business Case Title:**
   Implementation of traceability records and ESG (Environmental, Social and Governance) credentials to improve the transparency of the coffee supply chain
b. **Economy of execution:** Perú
c. **Industry member:** Cooperativa Agraria Norandino Ltda

#### 5.3.2. SECTION 2 - Introduction

The Norandino Agrarian Cooperative Ltd. brings together more than 6,500 coffee, cocoa, panela, and coffee-derived products producers in the regions of Piura, Tumbes, Amazonas, Cajamarca, Lambayeque and San Martín in northern Peru. Recognized as one of the economy's leading coffee exporters, it ranks tenth in commercial exports and is the first among producer cooperatives, with a processing plant capable of producing up to 500,000 quintals per year. Norandino operates with a focus on social, economic, and environmental responsibility, encouraging the participation of women (22% of its members) and young people under 30 (8%). It also holds important certifications that support its sustainability: organic (USDA Organic, European Union, and MIDAGRI in Peru), fair trade (FLO-CERT, Rapunzel HAND IN HAND, FAIRTRADE, and SPP), climate and carbon certification (a pioneer in the sale of carbon credits in the Fair-Trade market and Flocert Fair Trade-Climate certification), and environmental management certification (Sierra Piura Reforestation Project). These accreditations reinforce its

leadership as a benchmark in responsible production, ethical trade, and climate change mitigation.

The objective of its participation in the APEC project was to strengthen and implement traceability processes and ESG credentials that meet the requirements of international markets in North America, Europe, and Asia. This allows it not only to make its supply chain transparent and guarantee the sustainability of its products, but also to increase its competitiveness and open new export opportunities. Through the project, the cooperative integrated information on producers, processes, certifications, and audits into an interoperable digital platform, contributing to the economic development of its members and generating greater trust among consumers and business partners.

### 5.3.3. SECTION 3 - Blue Block[11]

a. Operational Times reduction by 25%
b. 100% Critical Processes covered by traceability
c. 100% Global Data Standards adoption rate
d. Certifications obtained: USDA Organic, Organic Peru, Fair Trade, Rainforest Alliance, Hand in Hand
e. Through the "Sierra Piura" Reforestation project, it has issued a total of 19,430 carbon credits between 2010 and 2023, positioning itself as the first small-scale producer organization in the world to market these credits in that market.

### 5.3.4. SECTION 4 – Coffee Supply Chain Development

A key priority for the Cooperative is the implementation of traceability and ESG processes, in line with the growing requirements of international markets such as Canada; U.S.; Europe; and Asia. They currently have ESG credentials, but they are not stored in a single location and are managed by the certification department. Although they have traceability records, due to the certification requirements of the coffee sector, these records are not online or digitized. APPAGROPs' technical staff manages handwritten traceability in the field, while the certification and production department manage traceability in isolated computer systems (Conta Plus and Certi Plus) at the processing plant.

Cooperativa Agraria Norandino Ltda is a member of GS1 Peru and currently uses Global Data Standards (GDS) through 13 assigned GTIN (Global Trade Item Numbers) codes and 37 GLN (Global Location Codes). These codes were allocated to the locations of producers' plots, the processing plant, and the storage facility for finished products. A new GTIN was assigned for the jute bags of green coffee for export and Norandino will be supported in assigning 2D codes to show coffee information.

Norandino Macroregional is a base-level organization (organized by regions) that brings together zonal Organizations (organized by district), which in turn are composed of APPAGROPS (organizations by village) that group individual producers. The Norandino Agrarian Cooperative comprises 10 base organizations, of which 3 are in Piura. Detailed explanation is in Figure 21.

[11] Visual box, typically in blue, used to highlight and summarize key information—such as main outcomes, strategic insights and recommendations.

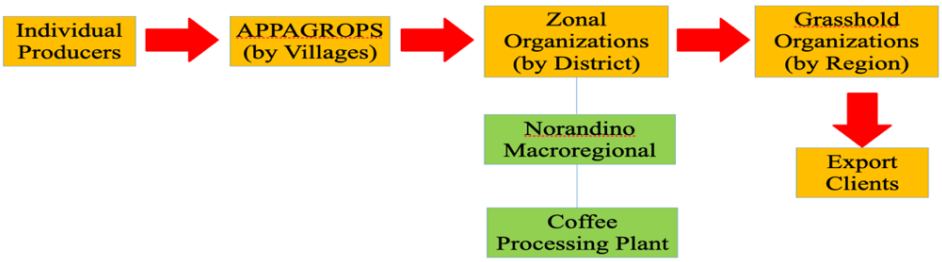



*Figure 21 – Coffee Supply Chain Processes – Source: Own Elaboration*

a. **Collecting data**

As part of the designed methodology, this stage was to identify two key components for building the process maps: Critical Tracking/Monitoring Events (CTEs) and Key Data Elements (KDEs). Together with the definition of the Global Data Standards (GDS) and the data repository, these will make it possible to properly customize the traceability platform that will support the implementation of the pilot projects.

Figure 22 and 23 shows detailed information and documentation on events (CTEs) and records/key data elements (KDEs) were collected, and these process maps are the result of field activities (pre-harvest, harvest, wet processing and collection) as well as plant activities (reception, processing, and dispatch).


*Figure 22 - Mapping Process for Coffee Supply Chain. Source: Own Elaboration*

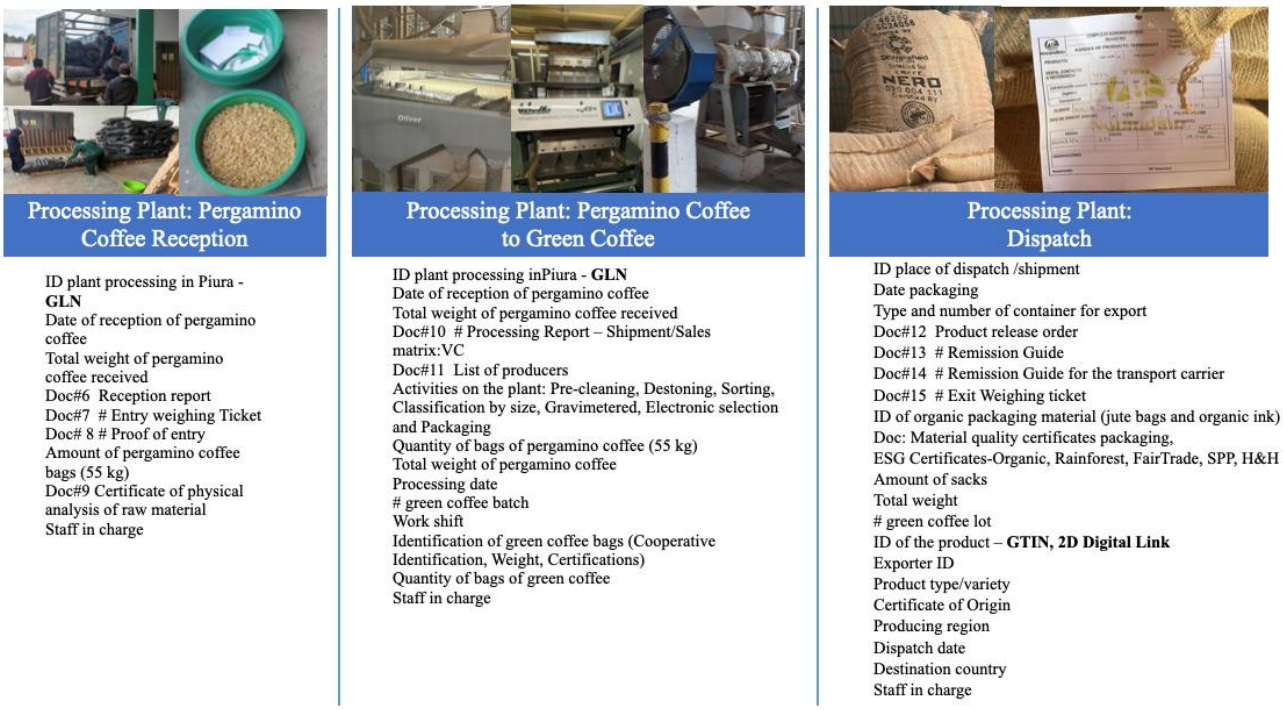



*Figure 23 - Mapping Process for Coffee Supply Chain. Source: Own Elaboration*

b. **Filling the information**

For the traceability & ESG credentials implementation, the visibility platform developed by the contractor, GS1 Peru, was used; during the implementation phase, the platform operated smoothly, requiring no technical support and a single database backup was performed at the conclusion of the phase.

The platform has managed two user roles: 1. Administrator role, assigned to a GS1 Peru team member, responsible for configuring the platform and managing user access and 2. Data Logger role was dedicated to entering traceability data and had access to the web application's query module to verify synchronization processes. For the coffee supply chain, four Data Logger accounts were created: two for collecting data near the crop lots and two for capturing information at the processing plant, with two of these accounts designated as backups to ensure continuity in the event of user absence and uninterrupted operations.

It's also relevant to mention the following main functionalities of the GS1 Peru visibility platform used in this implementation the details of which can be seen in Figure 24, as it enables comprehensive management of traceability records and ESG credentials across the supply chain, following global standards. A key feature is its ability to configure Critical Tracking Events (CTEs) and Key Data Elements (KDEs) at each stage of the supply chain, ensuring consistent and structured data capture. Additional functionalities include the management of supply chain actors, input and visualization of traceability data, generation of audit trails and real-time access to product information through 2D code scanning, features that contribute to greater transparency, traceability and operational efficiency.


*Figure 24 – Platform interface with traceability registries. Source: Own Elaboration*

In the coffee products, training on the use of the Traceability platform was conducted with both technicians from the Los Ranchos, APPAGROP SAPSE (Canchaque-Huancabamba) settlement and staff at the coffee processing plant in the city of Piura. See details in Figure 25.


*Figure 25 – Training process through GS1 Perú as local facilitator. Own Elaboration*

c. **Project outcome**

This implementation uses the 2D Digital Link standard to enable instant access to traceability and ESG data via mobile scan. This supports MSMEs and enhances transparency using Global Data Standards (GDS). It adds value to products and involves all stakeholders across the supply chain. See a tag that incorporate the 2D code, so we invite you to scan the 2D code from Figure 26 using your mobile devices. Production batch No.: VC 2423 was performed on-site at the processing plant and can be verified at the following link:

https://apec-trace-norandino.com/nor/01/7756456000004/10/VC2423. Figure 27 shows how traceability and ESG credentials is displayed in the web app in a very simple way, just by scanning it with a mobile phone.


*Figure 26 – Bulk of Coffee product with 2D code as Export Packaging. Source: Own Elaboration*

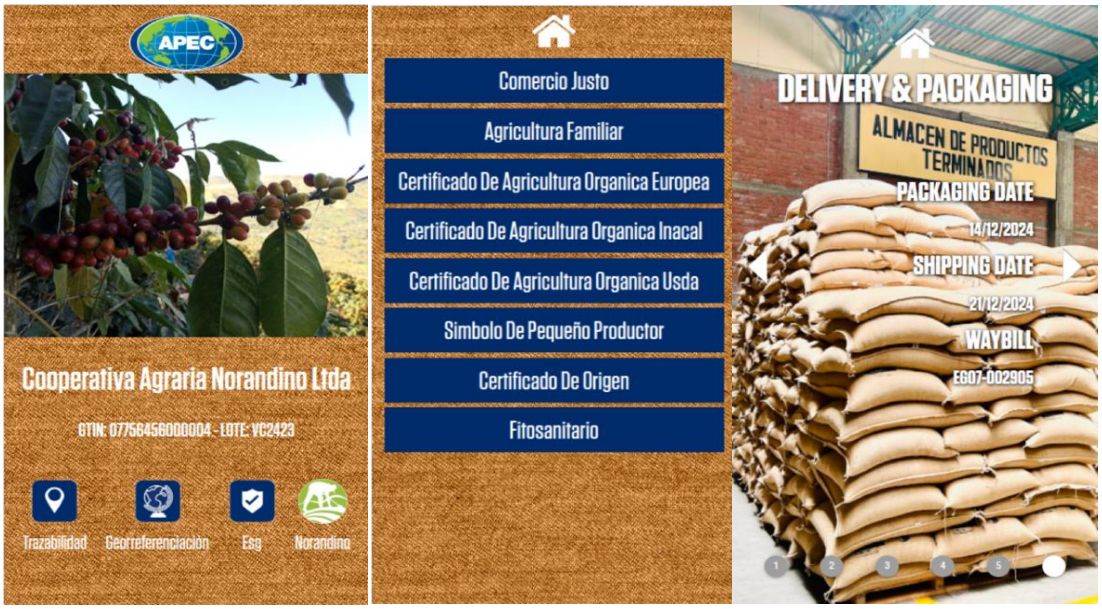



*Figure 27 – Platform interface with product, brand, traceability and ESG information. Source: Own Elaboration*

d. **Key Performance Indicators - KPIs**

The following improvements have been identified to guarantee supply chain transparency facilitating international trade in Norandino. They are grouped into six categories, as defined in the roadmap and derived from the execution of the pilots.

Before Pilot: □ After pilot: ■

| KPI CATEGORY | KPI | NONE (ZERO) | FOUNDATION | INTERMEDIATE | PROFICIENT | EXPERT |
|---|---|---|---|---|---|---|
| **Product and Process Coverage** | % of Suppliers with Traceability Registries (Supply Chain Visibility) | | □ | | | ■ |
| | % of critical processes covered by traceability (Supply Chain Visibility) | | □ **30%** | | | ■ **100%** |
| **Data Quality and Accuracy** | % of Records with Complete Information | | □ | | | ■ |
| | % of error-free records | | □ | | ■ **Reduced by 50%** | |
| **GDS - Global Data Standards** | Global Data Standards - GDS adoption rate | | □ **40%** | | | ■ **100%** |
| **ESG Credentials Implementation** | % of Products/Processes with verified sustainability certifications | | | □ | | ■ |
| **Regulatory Compliance and Audits** | % of compliance with applicable traceability regulations | | | □ | | ■ |
| **Business and Management Impact** | Digital Traceability Adoption and Productivity Improvement (Digitalization Rate) | | □ **20%** | | ■ **80%** | |
| | Digital Traceability Adoption and Productivity Improvement (Productivity Gain by Reduction of operational times) | | □ | | ■ **Reduced by 25%** | |

### 5.3.5. SECTION 5 - Conclusions

The general aim was to accelerate the digital sharing of reliable traceability and ESG credentials across the value chain through interoperable technologies. Based on the GS1 Global Data Standard, a full supply chain traceability system was established from raw material production to end products, integrating ESG certifications and traceability data into the pilot visibility platform. MSMEs, despite differences in business models and IT capacities, adopted GS1 Digital Link 2D codes supported by global identifiers such as GTIN and GLN, addressing data silos, improving transparency, and enabling information sharing across the supply chain. This implementation empowers MSMEs, promotes compliance with global regulations, strengthens trust with consumers and regulators, and provides a replicable digital solution for sustainable development across APEC economies.

# 6. BEST PRACTICES IN END-TO-END SUPPLY CHAIN INTEGRATION WITH DIGITAL TRACEABILITY AND ESG CREDENTIALS.

## 6.1. PEOPLE'S REPUBLIC OF CHINA'S TEXTILE SUPPLY CHAIN

### 6.1.1. Project Summary

People's Republic of China's pilot project showcased a distinctive best-practice approach for complex textile supply chain scenarios. Unlike other product categories, textiles face unique challenges: extended multi-tiered supply chain structures with various materials, divergent frameworks spanning from international credentials (OEKO-TEX®[12], GOTS[13], BLUESIGN®[14]) to domestic certifications (organic/green products).

To address these challenges, Chinese enterprises leveraged GS1 standards to explore viable solutions—assigning Global Trade Items Numbers (GTINs) for product identification and Global Location Numbers (GLNs) for business entity and location identification; then applying 2D code to the final product, ensuring real-time access to information via mobile devices. This enabled consolidated digital access via 2D Digital Links to farming, production and weaving ESG data (carbon footprints, organic certifications, quality control, etc.), creating a traceable "Digital Product Passport (DPP)".

### 6.1.2. Traceability and ESG Practices

The textile industry faces challenges in establishing credible digital sharing of ESG credentials. By collaborating with certification bodies, this project linked platform certification information directly to the official websites of certifiers, enabling users to verify the authenticity and validity of certificates. Simultaneously, it linked credential data to globally standardized identifiers, addressing the industry gap in certificate consolidation and data authenticity. This approach enhances the reliability of ESG disclosure.

### 6.1.3. Pilot Implementation and Achievements

Synchronization with the Global Registry Platform (GRP)[15] made product information globally accessible and verifiable. The application of international standards empowered companies to efficiently meet emerging regulations like the EU Digital Product Passport while driving green transformation and securing global market access—showcasing People's Republic of China's commitment to trusted and sustainable trade.

The realization of traceability systems and ESG transparency relies on the collaborative contributions of all stakeholders in the global supply chain. During the project's implementation, GS1 China has received strong support from the Ministry of Commerce (MOFCOM) and the State Administration for Market Regulation (SAMR), along with active cooperation from industry associations like the "China Textile and Apparel Council (CNTAC)" – and certification bodies such as the China Quality Certification Center (CQC). Additionally, the textile industry already had a certain level of digital

[12] *OEKO-TEX® is an international association that provides standardized testing and certification for textile products to ensure they are free from harmful substances and safe for human use. The most well-known standard is STANDARD 100 by OEKO-TEX®, which certifies that every component of a product has been tested for harmful chemicals.*

[13] *Global Organic Textile Standard is a leading international certification for organic textiles. It ensures that products are made from organically produced raw materials and that environmentally and socially responsible manufacturing practices are followed throughout the entire supply chain—from harvesting to labeling.*

[14] *Certification system focused on sustainable and safe textile production. It ensures that chemicals, water, energy and materials used in the production process are safe for the environment, workers and consumers by applying strict safety and environmental criteria.*

[15] *A global platform that enables the reliable and standardized exchange of product master data between companies across the supply chain, using GS1 standards.*

foundation and ESG awareness, and it is precisely through the close collaboration of all parties and the in-depth participation of MSMEs that the project successfully formed practical case studies demonstrating traceability and ESG transparency.

#### 6.1.4. Conclusion

The pilot highlighted People's Republic of China 's commitment to sustainable trade and ability to meet emerging regulations through international standards, driving green transformation and global market access.

## 6.2. INDONESIA'S PALM SUGAR SUPPLY CHAIN

#### 6.2.1. Project Summary

Temon Agro Lestari CV, a palm sugar processing MSME located in Pacitan, East Java, Indonesia, serves as a model of sustainable local empowerment and organic production. Specializing in molded, liquid, and granulated palm sugar, the company emphasizes environmental stewardship and traditional practices. Although operating with manual systems, it participated in the APEC CTI 207 2023A pilot to implement digital traceability and ESG credential solutions using global data standards (GDS).

#### 6.2.2. Traceability and ESG Practices

Temon Agro Lestari's operations are certified under HALAL, BPOM, and HACCP standards. Palm sugar is produced organically, with sustainability practiced from cultivation through to final packaging. ESG information is currently maintained in physical formats, but the project digitized key operations and processes, from pre-harvest to packaging, with 2D codes for digital access. Moreover, the pilot demonstrates best practices in implementing traceability and ESG credentials: despite not having information systems in place, the company was able to adopt the project successfully by relying on the consistent use of global standards for product identification, continuous training, and a simple, user-friendly technological solution. This enabled them not only to establish traceability but also to gain real-time visibility of their processes—an unprecedented capability that delivered additional benefits beyond traceability, including efficiency improvements and better decision-making.

#### 6.2.3. Pilot Implementation and Achievements

a. Manual operations were mapped across pre-harvest, harvest and processing stages.
b. Implementation of GS1 Global Data Standards (GDS), including Global Trade Item Numbers (GTINs) and Global Location Numbers (GLNs), for product and location identification.
c. Integration of 2D Digital Link codes to display real-time traceability and ESG data.
d. Use of GS1 Peru's visibility platform to digitize traceability workflows and enable mobile-based data access.
e. Improved traceability, ESG visibility and market credibility through digital tools.

#### 6.2.3. Conclusion

The pilot highlighted that MSMEs can significantly strengthen their operations by formalizing Standard Operating Procedures (SOPs) to ensure consistency and quality, and by transitioning from manual to digital record-keeping to enhance monitoring and traceability. The adoption of GS1 Global Data Standards—such as GTINs, GLNs and 2D Codes—proved to be essential for building scalable solutions, while the use of simple visibility platforms centralized information and improved access to both traceability and ESG data.

Moreover, the experience demonstrated that supporting digital transformation fosters MSME integration into broader markets and export channels. Even small-scale

producers successfully adopted global standards and simple digital tools, achieving not only improved product traceability and sustainability but also real-time process visibility. This scalable best practice provides a valuable model for replication across MSMEs in other APEC economies.

## 6.3. INDONESIA'S COFFEE SUPPLY CHAIN

### 6.3.1. Project Summary

Sevel Big Miracle is a family-owned MSME in Indonesia producing specialty Binturong coffee for the domestic market, with ambitions to enter international markets and enhance its value chain operations. The company collaborates with Lasico Coffee, a collective of local farmers from South Sulawesi and is led by its founders, Mr. Asep Saepudin and Mrs. Elis Hadiyani. Prior to the pilot, Sevel Big Miracle had no digital traceability system in place; all traceability and ESG records—such as bean reception, roasting approvals and sustainable sourcing data from the Lompobattang region—were manually documented using Excel and paper forms. The pilot aimed to drive digital transformation, improve supply chain transparency and optimize among others the marketing of MSME products through Global Data Standards (GDS).

### 6.3.2. Traceability and ESG Practices

The coffee supply chain was mapped from bean harvesting through processing and packaging. Critical Tracking Events (CTEs) and Key Data Elements (KDEs) were captured and used to build a comprehensive digital process map. Sevel Big Miracle is a member of GS1 Indonesia and uses Global Trade Item Numbers (GTINs) and Global Location Numbers (GLNs) identifiers for its products and facilities. In this pilot, 2D codes were added to primary packaging.

### 6.3.3. Pilot Implementation and Achievements

Traceability and ESG records were implemented on the GS1 Peru visibility platform, tailored for Sevel Big Miracle. Key Performance Indicators (KPIs) defined include supply chain visibility, roasting level monitoring and inventory management. Traceability reports enable forward and backward product tracking, essential for crisis response.

The traceability system was implemented in March–April 2025. Product traceability and ESG data are accessible via 2D Digital Link codes printed on final product packaging. The digital platform allows stakeholders to scan codes for instant information, supporting traceability records, audit trails and visualization of ESG credentials. It enables structured data input based on global standards, offering transparency and enhancing operational efficiency.

### 6.3.4. Conclusion

The pilot with Sevel Big Miracle demonstrates the viability of implementing digital traceability in MSMEs using Global Data Standards (GDS). This best practice highlights the benefits of digital transformation, enabling market access, regulatory compliance and improved product trust among consumers.

## 6.4. PERU'S COFFEE SUPPLY CHAIN

### 6.4.1. Project Summary

The implementation of digital traceability and Environmental, Social and Governance (ESG) credentials by Cooperativa Agraria Norandino Ltda represents a key best practice in the sustainable transformation of coffee supply chains in Peru. Norandino is a leading cooperative with over 6,500 small-scale producers across northern Peru. Through the

adoption of GS1 Global Data Standards (GDS), the cooperative enhanced transparency and data alignment with international trade and sustainability requirements.

#### 6.4.2. Traceability and ESG Practices

Norandino applied 2D Digital Link barcodes to green coffee export jute bags, enabling real-time access to traceability and ESG data via mobile devices. This allowed customers and regulators to verify batch data directly online. The platform's functionalities included visualization dashboards, audit trails and stakeholder data access—enhancing transparency and operational efficiency. They integrated ESG certifications (USDA Organic, Fair Trade, Rainforest Alliance) and traceability records into a unified platform with mobile access via 2D codes for real-time verification.

#### 6.4.3. Pilot Implementation and Achievements

The project utilized the GS1 Peru visibility platform to manage traceability and ESG data. The platform's ability to configure Critical Trace Events (CTEs) and Key Data Elements (KDEs) ensured structured and consistent data collection throughout the pre-harvest, processing, and shipping stages. Two types of user roles were created: Administrator and Data Logger, to manage platform configuration and data entry, respectively. Four Data Logger accounts were used for data collection at the crop and plant levels, ensuring continuity even during staff absences.

The pilot generated significant impacts, increasing the level of digitized records from 20% to 80% across harvest, transportation, and certification processes. Operating time was reduced by 25% and transcription errors by 50%, while the traceability system improved by 60%, ensuring full visibility from harvest to export. One of the key milestones was the 100% application of GS1 Global Standards—GTINs, GLNs, and 2D Digital Link—to uniquely identify locations, products, and export packaging. In addition, ESG certifications such as USDA Organic, Fair Trade, and Rainforest Alliance were integrated into the digital platform alongside traceability records, consolidating all information in one system. Finally, mobile access to traceability and ESG data through 2D Digital Link strengthened buyer confidence and reinforced the overall credibility of the supply chain.

#### 6.4.4. Technology and Innovation

Norandino applied 2D Digital Link barcodes to green coffee export jute bags, enabling real-time access to traceability and ESG data via mobile devices. This allowed customers and regulators to verify batch data directly online. The platform's functionalities included visualization dashboards, audit trails and stakeholder data access—enhancing transparency and operational efficiency.

#### 6.4.5. Conclusion

This best practice strengthens MSMEs participation in global supply chains through digitalization. It demonstrates how the integration of Global Data Standards (GDS), traceability records and ESG credentials enables companies to meet international compliance requirements while building trust with consumers and trading partners. It also provides a scalable model for other cooperatives and value chains in APEC economies seeking to achieve sustainable and transparent trade.

### 6.5. PERU'S WOOD SUPPLY CHAIN

#### 6.5.1. Project Summary

Maderera Canales Tahuamanu S.A.C. (Catahua), a Peruvian forestry company managing over 52,000 hectares of concession area, implemented a best practice by integrating traceability records and ESG (Environmental, Social and Governance)

credentials into its operations using both a domestic traceability platform (SNIFFS) and GS1 Peru's visibility system. The company holds FSC[16] certifications and has developed high standards for sustainable forest management and wildlife protection.

#### 6.5.2. Traceability and ESG Practices

To enhance transparency and operational efficiency, Catahua leveraged the Peruvian government's traceability platform SNIFFS, operated by SERFOR. This platform integrates modules for forest logging, transformation, and transport. Instead of duplicating efforts, the pilot developed a digital link between SNIFFS and GS1 Peru's platform, enabling visualization of traceability and ESG data in one interface through the 2D code. Although Catahua did not originally use global data standards, the project introduced GTIN-13 codes for finished decking products and GLNs for plot, processing, and storage locations. These were complemented with 2D codes that, when scanned, link to ESG and traceability information, enhancing digital transparency for MSMEs in the timber sector.

#### 6.5.3. Pilot Implementation and Achievements

All critical tracking events (CTEs) and key data elements (KDEs) were mapped across the forestry and sawmill stages. Traceability records were digitized, and a traceability manual was created. ESG data, including high conservation value zones and tree origin data, was integrated from existing documents and platforms like SNIFF. A web app was provided to read the internal QR code from SERFOR's Forest Transportation Waybill, redirecting users to the integrated traceability and ESG record platform. Though the current code is non-standard, the pilot demonstrated the feasibility and benefits of adopting GS1-compliant 2D codes for local or domestic platforms. This approach empowered forest sector MSMEs and offered a model for future government-standard alignment.

#### 6.5.4. Conclusion

This pilot demonstrated how existing government infrastructure can be enhanced through integration with global standards. By aligning with GS1 GDS and leveraging the SNIFFS platform, Peru is paving the way for transparent, digital, and sustainable forest product supply chains.

### 6.6. BEST PRACTICES LINKED TO ROADMAP

This section presents how the best practices identified during the pilot projects, structured explicitly in relation to the five phases of the Roadmap for the Implementation of Traceability Records and ESG Credentials. By aligning findings and outcomes with each phase, the analysis demonstrates how the pilots validated and informed the roadmap in practical contexts.

#### 6.6.1. Phase 1 – Preparation and Assessment

In all the pilots, the diagnostic assessment revealed fragmented ESG and traceability information, with certifications stored in paper or PDF formats dispersed and managed across different departments. This confirmed the need for a centralized digital repository and baseline definition of Critical Tracking Events (CTEs) and Key Data Elements (KDEs).

The general baseline in case of Peru and Indonesia (agroindustry) highlighted the need for digital tools accessible to small-scale processors and farmers.

[16] *Forest Stewardship Council. Certifications ensuring that products come from responsibly managed forests that provide environmental, social, and economic benefits. 2 Types: FSC Forest Management Certification – for forests that are managed sustainably and FSC Chain of Custody Certification – to track certified materials throughout the supply chain.*

### 6.6.2. Phase 2 – Identification and Planning

Global Data Standards were applied through the assignment of GTINs for the products and GLNs for production sites, as well as for processing and distribution facilities. Supply chain mapping was conducted to define Critical Tracking Events (CTEs) and Key Data Elements (KDEs) across all processes in the supply chains of the three (03) economies. This phase constitutes the core stage of the implementation, in which data is digitally captured and integrated into the platform, ensuring its availability for subsequent consultation, analysis, and operational use.

### 6.6.3. Phase 3 – Digital Registration and Documentation

Product, company, and certification information was registered in the visibility platforms made available for the pilot projects, demonstrating that their implementation is independent of the platform used. In fact, up to three different platforms were utilized: the GS1 Peru platform, applied in Indonesia (Palm Sugar and Coffee) as well as in Peru (Organic Coffee); the GS1 China traceability platform; and, in the case of Peru's wood supply chain, the traceability platform developed by the Peruvian government, SERFOR (National Forestry and Wildlife Service). In all cases, 2D Digital Link codes were generated and applied on hangtags or final products, providing integrated access to traceability and ESG credentials. A noteworthy example was the Peruvian coffee pilot, where the 2D code was successfully printed on a jute bag using a very traditional artisanal method—silk-screen printing—while still ensuring perfect readability.

These findings, together with the diversity of technological platforms tested during the pilot execution, confirmed the conclusion reflected in the roadmap: implementation is not hindered using different visibility platforms; what truly matters is their interoperability, which is achieved using Global Data Standards (GDS).

An important point to highlight is that, although the initial proposed methodology recommended the preparation of a Traceability Manual as part of the pilot implementation process, in practice this proved difficult to execute due to the size and dynamics of the participating companies. This led us to adjust the roadmap, considering the development of such a manual as desirable but not mandatory.

### 6.6.4. Phase 4 – Monitoring, Simulation and Validation

The pilot projects highlighted the importance of establishing baseline and post-implementation KPIs, as presented in this report. These indicators validated both the functionality and effectiveness of the implemented system and evidenced tangible improvements for participating MSMEs, including enhanced operational efficiency, greater digitalization and the reduction of manual errors. Such results reinforce the need to integrate KPI measurement as a key component of the roadmap.

### 6.6.5. Phase 5 – Scaling and Sustainability

The pilot demonstrated that even MSMEs could adopt global standards with targeted support. The approach provides a scalable model for other sectors with special focus on MSMEs in APEC economies.

# 7. REPLICABILITY AND SCALING TO OTHER APEC ECONOMIES

Building on the successful implementation of pilot projects in People's Republic of China; Indonesia and Peru, this section outlines how the solutions tested can be replicated and scaled across other APEC economies, highlighting the conditions that favor their adoption, and the steps required for regional expansion. Given its importance, this topic is not presented in isolation but is aligned with and considered as part of the Framework proposed in *Section 3.2.9. Expectations and Needs of Interested Parties and Section 3.2.10. Enabling Conditions.*

## 7.1. Target Economies for Replication

The pilot projects demonstrated that the proposed methodology is adaptable to a wide range of digital maturity levels. It can be successfully implemented by MSMEs with minimal or even no prior digital systems, if proper guidance, training and access to simple tools are provided. This inclusiveness is one of the key strengths of the approach, as it allows replication not only in highly digitalized economies but also in developing contexts where MSMEs often rely on manual processes.

While economies with medium to high digital readiness can accelerate adoption and scale more quickly, the methodology ensures that even those with lower maturity levels can gradually transition toward digital traceability and ESG credentials, thereby broadening the potential impact across all APEC economies.

A critical enabler for replication is strong regulatory alignment with the adoption of Global Data Standards (GDS). Governments play a decisive role, as their regulations can institutionalize the use of GDS as the common language for interoperability. When embedded in public regulations, these standards ensure that both government-driven and private sector platforms — regardless of their technology provider — remain fully open and interoperable. This guarantees that traceability and ESG data can flow seamlessly across different systems and economies, reinforcing trust, efficiency and scalability.

## 7.2. Stakeholders to Engage

- **Governments:** ministries of trade, agriculture, forestry, environment and digital transformation, among others to align regulations and institutionalize the use of Global Data Standard (GDS).
- **Enterprises:** MSMEs, Cooperatives and Larger Enterprises to implement traceability and ESG practices along the supply chain, including technology vendors.

  **International and Regional Organizations:** certification bodies, through the International Accreditation Forum (IAF), multilateral development banks such as the Inter-American Development Bank (IDB) and the World Bank, as well as regional development banks including the Development Bank of Latin America and the Caribbean (CAF) and the Asian Development Bank (ADB), industry associations for example global organizations such as the International Chamber of Commerce (ICC), the Consumer Goods Forum and GS1 Global, as well as regional associations including the Pacific Alliance, ASEAN and ALADI, among others that provide credibility, capacity building, financing and interoperability frameworks.

## 7.3. Phased Steps for Scaling

While the traditional path to scale would involve sequential steps — (1) regional pilots, (2) cross-border pilots and (3) general implementation — the experience within APEC demonstrates that significant progress has already been made through multiple forums, workshops and pilot projects, whose most relevant outputs are highlighted in *Annex 9.3. Global background and APEC references on Supply Chain Transparency, Traceability, Visibility and ESG Credentials*. However, there remains scope to develop new initiatives, particularly in cross-border that actively involve governments and their customs agencies, ensuring stronger institutional commitment and paving the way toward broader implementation.

Building on this accumulated work, the priority at this stage should shift toward Institutionalization, with member economies embedding Global Data Standards (GDS) into domestic laws and regulations, aligning public and private traceability platforms to avoid duplication and scaling from pilots to economy-wide and region-wide adoption. Pilots will still have value as demonstration and capacity building tools, but the focus should now be on:

### 7.4. Interoperability through Global Data Standards (GDS)

A key factor that will enable and facilitate both replication and scaling is the interoperability of platforms, which can only be achieved using Global Data Standards (GDS). By applying GTIN, GLN, SSCC and 2D Digital Link, the pilots demonstrated that MSMEs, governments, and private platforms can seamlessly exchange traceability and ESG data regardless of their underlying technologies. This highlights the importance of embedding GDS into regulatory frameworks and business practices to ensure that future implementations across APEC economies are scalable, replicable, inclusive and fully interoperable.

### 7.5. Sustaining Results Over Time

To ensure that the benefits of replication and scaling are not only achieved but also sustained over the long term, it is essential to embed mechanisms for continuous improvement and adaptation. This includes:

- **Ongoing Maintenance and Technological Updates**: Regular updates of digital platforms and traceability tools to keep pace with evolving technologies, cybersecurity requirements, and new data exchange protocols.
- **Continuous Financing and Resource Mobilization:** Establishing funding mechanisms through public budgets, international financial institutions, and public–private partnerships to support the long-term operation of traceability systems, particularly for MSMEs.
- **Institutional Capacity and Training Renewal:** Periodic training for government officials, certifiers, and MSMEs to reinforce knowledge, adapt to regulatory or technological changes, and build resilience in the use of Global Data Standards (GDS).
- **Monitoring and Evaluation Frameworks:** Setting up mechanisms to periodically measure impact, adoption rates, and system performance, ensuring accountability and enabling timely adjustments.
- **Multi-Stakeholder Collaboration:** Maintaining regional and cross-economy dialogue platforms to share lessons learned, update best practices, and align future strategies for interoperability and sustainability.

By integrating these measures, APEC economies can safeguard the continuity and relevance of traceability and ESG credential systems, ensuring that the value created through pilots and scaling efforts continues to deliver benefits well into the future.

# 8. RECOMMENDATIONS

**8.1. Adopt Global Data Standards:** Fully implement global standards (GDS) to achieve seamless data interoperability across upstream and downstream supply chains, ensuring smooth information flow and collaborative sharing, while promoting local or domestic and cross-economy interoperability (customs, certifications bodies, trade systems). Use identifiers GTIN (Global Trade Item Numbers for products), GLN (Global Location Numbers) for locations ensure consistency and traceability among all supply chain actors and **use the standard 2D Digital Link**, that allow the display of multi-dimensional information in a single scan, enhancing transparency, consumer experience and brand visibility. The mentioned above Global Data Standards has been evaluated and selected within a global benchmarking process (see detailed information in *Midterm Report Milestone 1 - Research and design of standardized processes, using global data standards for digital exchange of traceability and environmental, social and governance (ESG) credentials*).

In Peru's coffee pilot and People's Republic of China's silk and down coat pilots, interoperability across platforms was achieved using GS1 identifiers such as GTIN, GLN and 2D standards. Meanwhile, in Indonesia's coffee and palm sugar pilots, the feasibility of applying these global standards was demonstrated even among MSMEs with no prior digitalization, highlighting the inclusiveness and adaptability of the methodology.

**8.2. Empower MSMEs Digitalization:** Provide localized capacity building (training/tools in local languages with visual aids) and digital infrastructure support (subsidized/open-source tools, rural mobile connectivity). Encourage MSMEs to adopt traceability platforms aligned with global standards by providing public incentives (e.g., procurement preferences or tax benefits). Tailored sector-specific apps (e.g., for coffee, timber, or palm sugar) and simplified control points further reduce adoption barrier.

In Indonesia's coffee and palm sugar pilots, MSMEs without prior digitalization successfully used project-provided traceability tools, while in Peru's Norandino pilot, sector-specific apps with simplified control points helped reduce adoption barriers.

**8.3. Align Government Systems with International Standards:** Governments should ensure public traceability and certification platforms are interoperable with private systems by using shared standards. This compatibility enhances data flow between customs, regulatory authorities, certifiers and enterprises—supporting streamlined governance and scalable digital transformation.

In Peru's Catahua wood pilot, the integration between SERFOR's SNIFFS public system and the GS1 Peru platform highlighted the benefits of aligning government systems with Global Data Standards (GDS), while the People's Republic of China pilots demonstrated the potential for alignment with certification bodies, that is vital to ensure the trusted source of ESG credentials data declared by the company.

**8.4. Strengthen ESG Integration Across the Value Chain:** promote ESG credential verification across the value chain; facilitate partnerships between MSMEs and recognized certifiers (e.g., Fairtrade, Rainforest Alliance, CQC), enhancing ESG credential reliability and market trust. Embed ESG verification across the value chain.

In Peru's Norandino coffee and People's Republic of China's silk and down coat pilots, ESG credentials such as Fair Trade, Carbon Credit, OEKO-TEX, and GOTS were verified and linked through GS1 standards.

8.5. **Promote Standardized Information Access:** Scale global standard 2D codes to enable one-stop display of multi-dimensional information, facilitating access for consumers, partners and regulators to boost brand influence and regulatory compliance.

Across all pilots in People's Republic of China; Indonesia; and Peru, final products such as coffee, palm sugar, silk pajamas, down coats, and timber guides incorporated GS1 2D Digital Link codes, giving consumers and regulators access to traceability and ESG information through a single scan.

8.6. **Cross-Economy Pilots and Peer Learning:** Conduct cross-economy pilots (as in project CTI 207 2023A) to test locally adaptable models, including pilot labs for scalable solutions (experimental spaces to adapt tools to local contexts before wide implementation. Post-pilot, systematically expand proven traceability/digital solutions to more products (e.g., apparel) and industries, fostering widespread digital transformation, cross-border data sharing (e.g., digital payments/certificates to support international operations) and collaborative efficiency across the value chain.

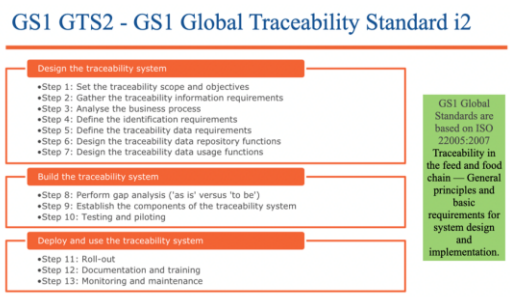
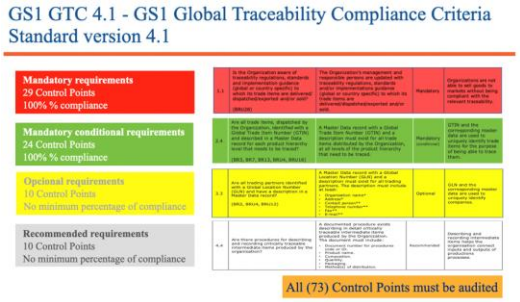
All the pilots demonstrated sector adaptability and potential to scale, while cross-economy learning under CTI 207 2023A proved interoperability, showing the need for further cross-border pilots with stronger government and customs involvement as mentioned before.

8.7. **Invest in Capacity Building for Sustainable Digital Transformation:** Capacity building is essential to ensure the successful implementation of digital traceability and ESG systems. Strengthen the skills of MSMEs, certifiers and public officers through tailored training, coaching, workshops and tools adapted to local languages and technical levels. Capacity building should be embedded in both domestic and regional digital transformation strategies to guarantee adoption, consistency and long-term sustainability of traceability systems.

In all pilots, we ensured as key success factor from the outset, the creation of permanent training and capacity-building spaces for participating MSMEs, covering not only the basic concepts of traceability and sustainability but also the use of digital tools, which were designed to be simple and user-friendly. This is why we strongly recommend placing particular emphasis on this aspect, as it forms the foundation for success.

# 9. ANNEXES

## 9.1. Research results on Traceability, ESG credential methodologies and Global Data Standards

| Research the Standard Process Methodology using international standards for the digital exchange of Traceability and ESG Credentials | | | | |
|---|---|---|---|---|
| **Traceability, ESG Credentials Methodology and GDS – Global Data Standards Research** | | | | |
| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **TRACEABILITY** | | | | |
| GS1 Global - Global Standards One | Global | GS1 GTS2 - GS1 Global Traceability Standard i2 | GS1 Framework for designing interoperable traceability systems for supply chains. It is a document based on GS1 standards for identification, data capture and data exchange. Designed for use in end-to-end supply chains from production to end of life and is relevant to all events spanning the life cycle of a traceable object.<br><br>https://www.gs1.org/<br>https://www.gs1.org/sites/default/files/docs/traceability/GS1_Global_Traceability_Standard_i2.pdf |  |
| GS1 Global - Global Standards One | Global | GS1 GTC 4.1 - GS1 Global Traceability Compliance Criteria Standard version 4.1 | Describes the criteria for full chain traceability, providing a single process to meet industry regulations and requirements using GS1 standards. It is used to perform traceability system assessments in industries.<br><br>https://www.gs1.org/docs/traceability/GS1_Global_Traceability_Criteria_CheckList_Standard.pdf |  |
| ISO | Global | Traceability ISO 22005:2007 Traceability in the feed and food chain — General principles and basic requirements for system design and implementation | This International Standard gives the principles and specifies basic requirements for the design and implementation of a feed and food traceability system. It can be applied by an organization operating at any step in the feed and food chain.<br>It is intended to be flexible enough to allow feed organizations and food organizations to achieve identified objectives.<br>The traceability system is a technical tool to assist an organization to conform with its defined objectives and is applicable when necessary to determine the history, or location of a product or its relevant components.<br><br>https://www.iso.org/standard/36297.html |  |

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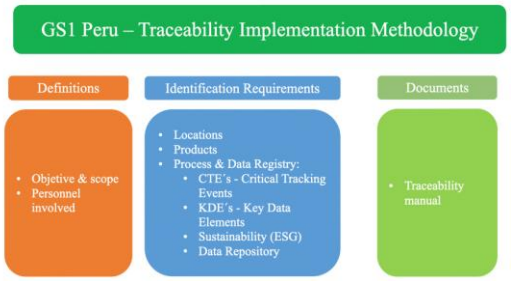
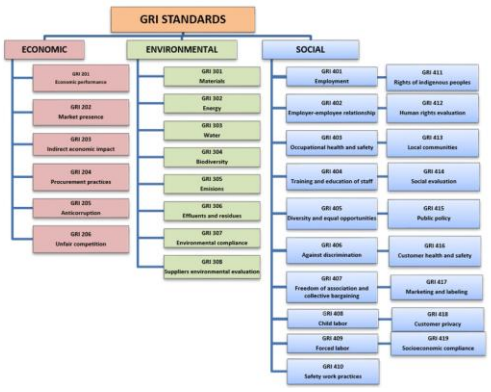
| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **TRACEABILITY** | | | | |
| GS1 Peru | Economy level | Traceability | Methodology used by GS1 Peru at the domestic level since 2008 and which is based on the GTC - Global Traceability Conformance framework of GS1 Global and then in 2017 it is complemented with the GTS - Global Traceability Standards. In Peru, various implementations have been carried out using this methodology in projects both in the private sector, as well as with public financing and international organizations, like World Bank, FAO, Ministry of Production, Ministry of Foreign Trade, Ministry of the Environment, Ministry of Economy and Finance, among others) in sectors such as: agribusiness, aquaculture, fishing, ornamental plants, livestock, wood, healthcare, education, among others. |  |
| GS1 China | Economy level | Traceability | Methodology used by GS1 China in their domestic traceability projects including MSMEs. They support their work with Easy Code Traceability, that is a product supply chain traceability platform provided by People's Republic of China's food (product) safety for production enterprises. In accordance with the GS1 EPCIS international standard and based on the feature of commodity barcode (GTIN), this service helps companies establish a product life cycle traceability system, meet the requirements of People's Republic of China's food safety traceability regulations and improve the transparency of supply chain information, facilitating the digital transformation of companies. |  |
| **ESG CREDENTIALS** | | | | |
| GRI - Global Reporting Initiative | Global | ESG | Standards, tools and training that enable organizations of all sizes to harness the skills, capabilities and data they need to create sustainable, long-term value and unlock positive change in the world.<br><br>https://www.globalreporting.org/ |  |

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| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **ESG CREDENTIALS** | | | | |
| SASB - Sustainability Accounting Standards Board | Global | ESG | Help companies disclose relevant sustainability information to their investors. Available for 77 industries, the SASB Standards identify the sustainability-related risks and opportunities most likely to affect an entity's cash flows, access to finance and cost of capital over the short, medium or long term and the disclosure topics and metrics that are most likely to be useful to investors.<br><br>https://sasb.ifrs.org/ |  |
| ISO | Global | ISO 26000 (Guidance on Social Responsibility | International standard providing guidance on social responsibility. It helps companies understand and implement socially responsible practices across seven core subjects, including human rights, labor practices and the environment.<br><br>https://www.iso.org/iso-26000-social-responsibility.html |  |
| SAI - Social Accountability International SA8000 | Global | ESG - Social | The SA8000 standard provides a framework for improving social accountability in the workplace, focusing on decent work, worker rights, and social justice, and is suitable for Companies aiming to enhance their social impact.<br><br>https://sa-intl.org/programs/sa8000/ |  |

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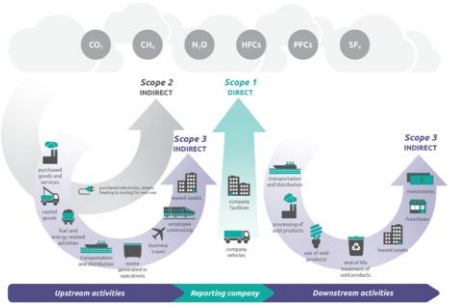
| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **ESG CREDENTIALS** | | | | |
| B Lab | Global | B Impact Assessment (B Corp Certification) | The B Impact Assessment allows Companies to measure and improve their social and environmental impact. B Corp certification also helps validate a company's commitment to ESG principles.<br><br>https://www.bcorporation.net/en-us/programs-and-tools/b-impact-assessment/ |  |
| UN United Nations International Labour Organization (ILO) and the International Finance Corporation (IFC), a member of the World Bank Group | Global | ILO's Better Work Program | Helps Companies in the garment and textiles sectors improve working conditions and comply with labor standards.<br><br>https://www.betterwork.org/programme/ | **PILLAR 1**<br>**Stimulating the economy and employment**<br>• Active fiscal policy<br>• Accommodative monetary policy<br>• Lending and financial support to specific sectors, including the health sector<br><br>**PILLAR 2**<br>**Supporting enterprises, jobs and incomes**<br>• Extend social protection for all<br>• Implement employment retention measures<br>• Provide financial/tax and other relief for enterprises<br><br>**PILLAR 3**<br>**Protecting workers in the workplace**<br>• Strengthen OSH measures<br>• Adapt work arrangements (e.g. teleworking)<br>• Prevent discrimination and exclusion<br>• Provide health access for all<br>• Expand access to paid leave<br><br>**PILLAR 4**<br>**Relying on social dialogue for solutions**<br>• Strengthen the capacity and resilience of employers' and workers' organisations<br>• Strengthen the capacity of governments<br>• Strengthen social dialogue, system of collective labour agreements and labour relations institutions and processes<br><br>*Source:* ILO, 2020b, p. 4 |
| CDP (formerly Carbon Disclosure Project) | Global | | Companies can voluntarily disclose their environmental data through CDP, which is a global platform for reporting climate-related, water-related, and supply chain impacts.<br><br>https://www.cdp.net/en |  |
| Ecovadis | Economy level (Spain) | | A platform that provides sustainability ratings for global supply chains, and Companies can use to assess their sustainability performance across multiple criteria, such as labor rights and environmental impact.<br>https://ecovadis.com/es/ |  |

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| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **ESG CREDENTIALS** | | | | |
| Financial Stability Board (FSB) | Global | Task Force on Climate-related Financial Disclosures (TCFD) | Framework for disclosing climate-related financial risks, which Companies can adopt to demonstrate transparency in managing climate risks.<br><br>https://www.fsb-tcfd.org/ |  |

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| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **GDS – GLOBAL DATA STANDARDS: GLOBAL ORGANIZATIONS** | | | | |
| APEC | Global | Study on the Application of Global Data Standards for APEC Supply Chain Connectivity (Phase 1) - February 2017 | Study on the Application of Global Data Standards for APEC Supply Chain Connectivity, based on cross-border pilots between Australia; Hong Kong, China and United States.<br><br>https://www.apec.org/publications/2017/02/study-on-the-application-of-global-data-standards-for-apec-supply-chain-connectivity-phase-1 | The main takeaway from this project was the adoption of global data standards (GDS) in supply chains that enables stakeholders to send and receive messages to each other in a globally consistent language, helping them monitor cargo, transportation assets such as containers and trucks, storage and delivery locations, and report on events throughout the shipment such as traffic congestion, accidents, and port delays.<br>By adopting common identifiers for goods, transportation equipment, locations, and events, activities in the supply chain can be viewed from supplier to customer.<br>To demonstrate this capability, two pilot projects were conducted to test the utilization of GDS in supply chain connectivity. These pilot projects involved cross-border shipments of wine and beef between APEC members including Australia; Hong Kong, China; and United States. The GDS pilot projects aimed to complement this existing transactional data with transportation event messages and a transportation instruction interface using GS1 standards and Electronic Product Code Information Services (EPCIS). |
| APEC | Global | Study on the Application of Global Data Standards for APEC Supply Chain Connectivity (Phase 2) - November 2017 | Study on the Application of Global Data Standards for APEC Supply Chain Connectivity, based on cross-border pilots: Asparagus Peru to the United States, Durian Malaysia to the People's Republic of China and Hong Kong,China, and Tequila Mexico to the United States.<br><br>https://www.apec.org/publications/2017/11/study-on-the-application-of-gds-for-supply-chain-connectivity-phase-2 | In November of that same year, the APEC Study on the Application of Global Data Standards for Supply Chain Connectivity was conducted, based on three cross-border pilots: Asparagus from Peru to the United States, Durian from Malaysia to People's Republic of China and Hong Kong, China and Tequila from Mexico to the United States. The use of Global Data Standards (GDS) are relevant for most phases of the supply chain, starting from exporters, third-party logistics providers, customs and/or border agencies to importers. The objective of this project was to examine how the application of GDS can improve supply chain visibility and efficiency based on these three GDS pilot projects. Performance is assessed in terms of visibility/traceability, risk management/integrity, responsiveness, collaboration, and innovation. GDSs can improve these processes by providing a common language to identify, capture and share supply chain data with all stakeholders along the supply chain through the use of radio frequency identification (RFID) tags and barcodes, as well as the Electronic Product Code Information Services (EPCIS) platform. As cross-border processes and transactions become increasingly electronic, GDSs can act as a common platform to ensure seamless data exchange between public and private sector organizations. The report included the list of GS1 Global Standards. |
| **GS1 Global and ISO:** ISO and GS1 Global have had a strong and constructive relationship for more than 20 years. A number of GS1 team members participate actively in ISO standard development committees, or even serve as their Chair or secretariat. Governmental regulations and laws often refer only to ISO standards, so having normative references to GS1 in ISO standards is very useful to promote the use of Global Data Standards. | | | | |

| Research the Standard Process Methodology using international standards for the digital exchange of Traceability and ESG Credentials | | | | |
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| **Traceability, ESG Credentials Methodology and GDS – Global Data Standards Research** | | | | |
| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **GDS – GLOBAL DATA STANDARDS: GLOBAL ORGANIZATIONS** | | | | |
| ISO | Global | ISO/IEC 15459-6:2014 | Information technology; AIDC techniques; Unique identification. Part 6: Groupings.<br><br>https://www.iso.org/standard/54786.html | **ISO SCOPE DEFINITION:**<br>Establishes a framework for the globally unique identification of groupings (i.e., collections of items such as pallets, logistic units, product batches, or sets of goods) through issuing agencies, enabling interoperability across different identification systems.<br>The character string is intended to be represented in a linear bar code symbol and two-dimensional symbol, or other automatic identification and data capture (AIDC) media attached to the entity to meet management needs and/or regulatory needs (e.g. customs clearance).<br><br>It reference existing Global Data Standards(GDS) systems such as GS1 in its informative annexes. GS1 identifiers, such as **GSIN – Global Shipment Identification Number (**assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together), supports interoperability across identification systems. |
| ISO | Global | ISO/IEC 15459-4:2014 | Information technology — Automatic identification and data capture techniques — Unique identification. Part 4: Individual products and product packages<br><br>https://www.iso.org/standard/54782.html | **ISO SCOPE DEFINITION:**<br>Establishes a framework for the globally unique identification of individual products and product packages through issuing agencies.<br>The character string is intended to be represented in a linear bar code symbol or two-dimensional symbol or other automatic identification and data capture (AIDC) media attached to the entity to meet management needs.<br><br>GS1 identifiers such as the **GTIN - Global Trade Item Number** (a globally unique identifier assigned to trade items to enable their identification across the supply chain) and the **GIAI – Global Individual Asset Identifier** (captures information about the asset used in the supply chain), are fully aligned with its principles, as they provide globally unique product identification under a governed issuing structure. |
| ISO | Global | ISO/IEC 15459-1:2014 (publication reviewed and confirmed in 2025) | Information technology — Automatic identification and data capture techniques — Unique identification. Part 4: Individual products and product packages<br><br>https://www.iso.org/standard/54779.html | **ISO SCOPE DEFINITION:**<br>Establishes a framework for the globally unique identification of individual transport units (e.g., pallets, shipping containers, cartons, or logistic handling units) through issuing agencies. While the standard remains neutral regarding specific systems in its normative content, it explicitly references GS1 in its informative Annex A as an example of a globally implemented identification system for transport units.<br><br>In this context, the **GS1 SSCC - Serial Shipping Container Code** is used to uniquely identify logistic units and supports interoperability in line with the principles defined in this standard. |

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| ISO | Global | ISO/IEC 6523-1:2023 | Information technology — Structure for the identification of organizations and organization parts Part 1: Identification of organization identification schemes.<br><br>https://www.iso.org/es/contents/data/standard/08/22/82246.html | **ISO SCOPE DEFINITION:**<br>Defines a framework for identifying organization identification schemes through International Code Designators (ICDs). Various identification systems can be registered under this framework, enabling interoperability across different schemes.<br><br>GS1 identifiers, such as **GLNs – Global Location Numbers**, can operate within frameworks aligned with ISO/IEC 6523, supporting interoperability across identification systems. |
| ISO | Global | ISO/IEC 15459-5:2014 (publication reviewed and confirmed in 2025) | Information technology — Automatic identification and data capture techniques — Unique identification Part 5: Individual returnable transport items (RTIs).<br><br>https://www.iso.org/standard/54785.html | **ISO SCOPE DEFINITION:**<br>Establishes a framework for the globally unique identification of individual returnable transport items (RTIs), such as reusable pallets, crates, kegs, or containers, through issuing agencies.<br><br>It explicitly references GS1 in its informative Annex A as an example of a globally implemented identification system. In this context, GS1 identifiers such as the **GRAI - Global Returnable Asset Identifier** are used to uniquely identify returnable assets and support interoperability in line with the principles defined in this standard. |
| ISO | Global | ISO/IEC 15418:2016 (publication reviewed and confirmed in 2021) | Information technology — Automatic identification and data capture techniques — GS1 Application Identifiers and ASC MH10 Data Identifiers and maintenance<br><br>https://www.iso.org/standard/67405.html | **ISO SCOPE DEFINITION:**<br>Defines the structure and use of data identifiers for automatic identification and data capture systems, explicitly incorporating **GS1 AIs - Application Identifiers** within its normative content. These identifiers enable the standardized encoding of key data elements—such as product identification through GTIN – Global Trade Item Number, Batch Numbers, Expiry Dates, Serial Numbers, Dispatch Numbers, among others—supporting interoperability and consistent data exchange across supply chains.<br><br>In addition, the standard provides user guidance in Annex A, including considerations on the choice between GS1 Application Identifiers and ASC MH10 Data Identifiers (A.1), as well as practical guidance on working with GS1 Application Identifiers (A.2), further reinforcing the role of GS1 within the standard. |
| ISO | Global | ISO/IEC 15424:2025 | Information technology — Automatic identification and data capture techniques — Data Carrier Identifiers (including Symbology Identifiers).<br><br>https://www.iso.org/standard/46144.html | **ISO SCOPE DEFINITION:**<br>Defines the structure and use of data carrier identifiers, including symbology identifiers, to enable the consistent interpretation of barcodes and other data carriers across automatic identification systems. A data carrier is a medium used to encode and convey data in a machine-readable form (e.g., linear barcodes such as GS1-128, two-dimensional symbols such as GS1 DataMatrix or QR Codes and RFID tags).<br><br>The normative explicitly references GS1 in its informative Annex B, including symbology identifiers for GS1 application syntax. In this context, GS1 data carriers—such as **GS1-128, GS1 DataMatrix and GS1 2D Codes**—leverage these identifiers to ensure interoperability and consistent decoding of structured data across supply chains. |

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| ISO | Global | ISO/IEC 18004:2024 | QR Code bar code symbology specification Information technology — Automatic identification and data capture techniques — QR code bar code symbology specification.<br><br>https://www.iso.org/standard/83389.html | **ISO SCOPE DEFINITION:**<br>Defines the QR Code symbology, specifying how data is encoded, structured and decoded within two-dimensional barcodes. Specifies symbology characteristics, data character encoding methods, symbol formats, dimensional characteristics, error correction rules, reference decoding algorithm, production quality requirements, among others.<br><br>While the standard remains neutral regarding specific data structures or industry implementations, it provides the foundational symbology used by systems such as the GS1 QR Code. In this context, GS1 implementations—such as the **GS1 2D Digital Link**, which encodes standardized product identifiers and attributes (e.g., GTIN, batch, expiry) into web-resolvable URIs—leverage the ISO-defined QR Code structure while incorporating GS1 data syntax, enabling interoperability and consistent data exchange across supply chains. |
| ISO | Global | ISO/IEC 18975:2024 | Information technology — Automatic identification and data capture techniques — Encoding and resolving identifiers over HTTP.<br><br>https://www.iso.org/standard/85540.html | **ISO SCOPE DEFINITION:**<br>Defines how identifiers can be encoded as web-resolvable URIs and accessed over HTTP, enabling the integration of automatic identification systems with web technologies. The standard establishes principles for encoding identifiers, resolving them via HTTP, and delivering context-specific information through content negotiation.<br><br>While it remains neutral regarding specific implementations, it aligns with systems such as the **GS1 2D Digital Link**, which encodes standardized product identifiers (e.g., GTIN) into web-resolvable URIs, enabling dynamic access to product information across consumer, regulatory, and supply chain contexts, and supporting interoperability across digital ecosystems. |
| ISO | Global | ISO/IEC 16022:2024 | Information technology — Automatic identification and data capture techniques — Data Matrix bar code symbology specification<br><br>https://www.iso.org/standard/80926.html | **ISO SCOPE DEFINITION:**<br>Defines the Data Matrix symbology, specifying how data is encoded, structured and decoded within two-dimensional barcodes.<br><br>While the standard remains neutral regarding specific data structures or industry implementations, it provides the foundational symbology used by systems such as **GS1 DataMatrix**. In this context, GS1 DataMatrix—widely adopted in healthcare for the identification of pharmaceuticals, medical devices and surgical supplies—leverages the ISO-defined Data Matrix structure while incorporating GS1 Application Identifiers (e.g., GTIN, batch/lot, expiry date, serial number), enabling traceability, regulatory compliance and interoperability across healthcare supply chains. |

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| ISO | Global | ISO/IEC 16390:2007 (publication reviewed and confirmed in 2020) | Information technology — Automatic identification and data capture techniques — Interleaved 2 of 5 bar code symbology specification.<br><br>https://www.iso.org/standard/43898.html | **ISO SCOPE DEFINITION:**<br>Defines the Interleaved 2 of 5 barcode symbology, specifying how numeric data is encoded, structured, and decoded within linear barcodes used in logistics and distribution environments.<br><br>It provides the foundational symbology used by systems such as the **GS1 ITF-14 or GTIN-14** barcode. It encodes standardized product identifiers for outer packaging and logistic units, enabling interoperability and consistent identification across supply chains. |
| ISO | Global | ISO/IEC 15417:2007 | Information technology — Automatic identification and data capture techniques — Code 128 bar code symbology specification.<br><br>https://www.iso.org/standard/43896.html | **ISO SCOPE DEFINITION:**<br>Defines the Code 128 barcode symbology, specifying how alphanumeric data is encoded, structured and decoded within high-density linear barcodes. While the standard remains neutral regarding specific data structures or industry implementations, it provides the foundational symbology used by systems such as the GS1-128 barcode. In this context, GS1-128 incorporates standardized GS1 Application Identifiers (e.g., GTIN, batch/lot number, expiry date) to encode structured data, enabling interoperability, traceability, and consistent data exchange across supply chains.<br>SSCC - Serial Shipping Container Code used to uniquely identify logistic units, is typically encoded using the GS1-128 symbology with Application Identifier (00). |
| ISO | Global | ISO/IEC 24724:2011 (publication reviewed and confirmed in 2025) | Information technology — Automatic identification and data capture techniques — GS1 DataBar bar code symbology specification.<br><br>https://www.iso.org/standard/51426.html | **ISO SCOPE DEFINITION:**<br>Defines the GS1 DataBar barcode symbology, specifying how product identification and related data are encoded and decoded within compact linear barcodes. Unlike other symbology standards, this standard is explicitly aligned with the GS1 system of standards, as reflected in its scope and naming. GS1 DataBar enables the encoding of globally unique product identifiers (GTIN) and additional attributes using GS1 Application Identifiers, supporting interoperability, traceability, and efficient data capture across retail and supply chain environments.<br><br>**DataBar bar code symbology** GS1 DataBar was originally called the reduced space symbology. The smaller size was ideal for hard-to-mark items, like loose produce. The expanded GS1 DataBar options have additional capabilities that are not available from other simbologies. |
| ISO | Global | ISO/IEC 15962:2022 | Information technology — Radio frequency identification (RFID) for item management — Data protocol: data encoding rules and logical memory functions<br><br>https://www.iso.org/standard/76643.html | **ISO SCOPE DEFINITION:**<br>Defines data encoding rules and logical memory functions for RFID – Radio Frequency Identification systems used in item management, enabling standardized storage, access and interpretation of data within RFID tags. While the standard remains neutral regarding specific identification systems, it aligns with globally adopted frameworks such as the **GS1 EPC (Electronic Product Code)**, which defines how identifiers are encoded and managed within RFID environments. In this context, GS1 EPC standards support interoperability, traceability and consistent data exchange across RFID-enabled supply chains. |

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| ISO | Global | ISO/IEC 18000-63:2021 | RFID Specifcation: Radio frequency identification for item management, Parameters.<br>Information technology - Radio frequency identification for item management — Part 63: Parameters for air interface communications at 860 MHz to 960 MHz Type C.<br><br>https://www.iso.org/standard/78309.html | This document defines the air interface for radio frequency identification (RFID) devices operating in the 860 MHz to 960 MHz industrial, scientific and medical (ISM) band used in item management applications.<br>It provides a common technical specification for RFID devices that can be used to develop RFID application standards for readers and tags. This document is intended to allow for compatibility and to encourage inter-operability of products for the growing RFID market in the international marketplace.<br>This standard is aligned with the **GS1 EPCglobal UHF Class 1 Gen 2 protocol**, providing a globally interoperable foundation for RFID-based identification, data capture, and supply chain visibility. |
| ISO | Global | ISO/IEC 15415:2024 | Automatic identification and data capture techniques — Bar code symbol print quality test specification — Two-dimensional symbols<br><br>https://www.iso.org/standard/76876.html | Defines the print quality test specification for two-dimensional barcode symbols, establishing standardized methods to evaluate parameters such as symbol contrast, modulation, decoding performance and overall print quality. The standard ensures that 2D symbols can be consistently read and interpreted across scanning systems, supporting reliable data capture in automatic identification environments. While it remains neutral regarding specific implementations, it directly supports widely adopted systems such as **GS1 DataMatrix and GS1 QR Codes**, which rely on these quality specifications to ensure accurate encoding and decoding of structured data (e.g., GTIN, batch/lot, expiry date). |
| ISO | Global | ISO/IEC 15426-2:2023 | Information technology; AIDC techniques; bar code verifier conformance specification - Part 2: Two-dimensional symbols.<br><br>https://www.iso.org/standard/82440.html | Defines the conformance requirements for barcode verifiers used to assess the quality of two-dimensional symbols, ensuring that verification equipment operates consistently and in accordance with standardized measurement methods. While it remains neutral regarding specific data structures or industry implementations, it underpins widely adopted systems such as GS1 DataMatrix and GS1 QR Codes by ensuring that verification processes are consistent across devices and environments. |
| ISO | Global | ISO/IEC 29158:2025 | Automatic identification and data capture techniques — Bar code symbol quality test specification — Direct part mark (DPM)<br><br>https://www.iso.org/standard/87123.html | Defines the quality test specification for direct part marking (DPM) barcode symbols, establishing standardized methods to evaluate the readability and performance of symbols permanently marked on items, such as metal, plastic, or other industrial surfaces. The standard addresses the specific challenges of DPM, including surface reflectivity, marking methods (e.g., laser etching, dot peen) and varying contrast conditions, ensuring reliable decoding in industrial environments. |

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| ISO | Global | ISO/IEC 15459-2 (publication reviewed and confirmed in 2025) | Information technology — Automatic identification and data capture techniques — Unique identification. Part 2: Registration procedures<br><br>https://www.iso.org/standard/54780.html | Defines the registration procedures required to ensure the global uniqueness of identifiers within the ISO/IEC 15459 series, establishing the framework for the governance and allocation of Issuing Agency Codes (IACs). The standard specifies how issuing agencies are authorized, registered, and managed, ensuring that identifiers assigned under different schemes remain globally unique and non-overlapping.<br><br>While the standard remains neutral regarding specific identification systems, it provides the governance foundation under which globally recognized systems such as GS1 operate. In this context, GS1 functions as an issuing agency that allocates globally unique identifiers (e.g., GTIN, GLN, SSCC) in alignment with the principles defined in this standard, supporting interoperability and trusted data exchange across supply chains. |
| ISO | Global | ISO/IEC 15459-3:2014 (publication reviewed and confirmed in 2025) | Information technology — Automatic identification and data capture techniques — Unique identification. Part 3: Common rules<br><br>https://www.iso.org/standard/54781.html | Defines the common rules for the structure, assignment, and management of unique identifiers within the ISO/IEC 15459 series, ensuring global uniqueness and consistency across different identification schemes. The standard establishes general principles for identifier composition, data integrity, and interoperability, enabling multiple issuing agencies to operate within a harmonized framework.<br><br>While the standard remains neutral regarding specific identification systems, it provides the foundational rules under which globally recognized systems such as GS1 operate. In this context, GS1 identifiers (e.g., GTIN, GLN, SSCC) are fully aligned with these principles, supporting consistent identification, interoperability, and trusted data exchange across supply chains. |
| ISO | Global | ISO/IEC 15434:2025 | Syntax for high-capacity AIDC media Information technology - Automatic identification and data capture techniques — Syntax for high-capacity ADC media.<br><br>https://www.iso.org/standard/84566.html | Defines the syntax for encoding structured data in high-capacity automatic data capture media, enabling the transmission of multiple data elements within a single carrier. It establishes standardized message formats and delimiters to ensure consistent data interpretation across systems. While the standard remains neutral regarding specific implementations, it aligns with systems such as GS1, where structured data (e.g., GTIN, batch/lot, expiry date) is encoded using GS1 Application Identifiers, supporting interoperability and reliable data exchange across supply chains. |
| GS1 GO | Global | GS1 Standard: 2D Code, GTIN | GS1 General Specifications, referenced by ISO/IEC 15459 parts 1-6, ISO/IEC 15418, ISO/IEC 15424, ISO/IEC 15434.<br><br>https://ref.gs1.org/standards/genspecs/ | The foundational GS1 standard that defines how identification keys, data attributes and barcodes must be used in business applications. |
| GS1 GO | Global | GS1 Standard Version i1.1.2 | GS1 Digital Link URI Standard, referenced by ISO/IEC FDIS 18975.<br><br>https://ref.gs1.org/standards/digital-link/. | Enabling consistent representation of **GS1 2D Codes Digital Link** identification keys within web addresses to link to online information and services. |

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| GDST | Global | Global Dialogue on Seafood Traceability- GDST 1.2 | Standards and Guidelines for Interoperable Seafood Traceability Systems<br>Technical Implementation Guidance (Version 1.2)<br>JUNE 2023.<br><br>https://thegdst.org/wp-content/uploads/2024/01/GDST-1.2-Technical-Implementation-Guidance.pdf | The Standards and Guidelines for Interoperable Seafood Traceability Systems (Technical Implementation Guidance, Version 1.2, June 2023*)* provides a practical framework for implementing interoperable traceability systems across seafood supply chains, based on the capture of Critical Tracking Events (CTEs) and Key Data Elements (KDEs). The guidance emphasizes the use of GDS - Global Data Standards to enable system-to-system interoperability and consistent data exchange.<br><br>It explicitly recognizes the role of GS1 standards—such as identifiers (e.g., GTIN, GLN) and EPCIS for event-based data sharing—as key enablers for achieving scalable, interoperable, and transparent traceability across diverse stakeholders and geographies. |
| **APEC ECONOMIES** | | | | |
| AUSTRALIA | Economy level | Food Standards Australia New Zealand Act 1991 | This Act sets out the regulations for food safety and labelling in Australia and New Zealand. It requires traceability of food products throughout the supply chain.<br><br>https://www.legislation.gov.au/C2004A04193/latest/text | Food Standards Australia New Zealand (FSANZ) is responsible developing the Australia New Zealand Food Standards Code used to regulate food sold in Australia and New Zealand.<br>Some of the standards FSANZ develops apply to Australia and New Zealand, others apply to Australia only.<br>Food standards are enforced by Australian state and territory food regulatory agencies, the Australian Government's Department of Agriculture, Fisheries and Forestry (for imported food), and the New Zealand Government.<br>FSANZ also has other functions in Australia including coordinating food surveillance and food recalls. |
| CHILE | Economy level | Technical Standard 226 of Decree 63 | The Undersecretariat of Healthcare Networks of the Ministry of Health | On September 17, 2022, Exempt Decree No. 63 of the Ministry of Health was published in the Official Gazette, through which Technical Standard No. 226 was approved, which establishes the obligation to implement a data registration system that allows the traceability of medical devices at the time of their receipt by institutional health providers. |
| PEOPLE's REPUBLIC OF CHINA - SAMR and Customs | Economy level | People's Republic of China's State Administration for Market Regulation (SAMR) | The Measures for the Administration of Barcode for Commodity by People's Republic of China's State Administration for Market Regulation (SAMR). Link to the measure by SAMR:<br>https://www.gov.cn/zhengce/2021-06/25/content_5723646.htm | In order to standardize the management, ensure the quality and accelerate the application of commodity barcodes (Global Trade Item Number, GTIN) in the fields of e-commerce and commodity circulation and digitalization, former General Administration of Quality Supervision (State Administration for Market Regulation[SAMR], PRC), in accordance with the relevant provisions of the state, this measure is formulated: GS1 China has been assigned as the domestic commodity barcode working organization, responsible for the specific implementation of domestic commodity barcode management. Any unit or individual using the commodity barcode must be approved and registered in accordance with this measure, obtain the Global Company Prefix (GCP), and become a member company of GS1 China. Producers, sellers and service providers who have obtained business licenses and relevant legal business qualification certificates in accordance with the law may apply for the registration of Global Company Prefix (GCP). The member companies shall compile commodity barcodes in accordance with relevant domestic standards and report product information to the local GS1 China branches. This measure was published in May 30th, 2005, effective from Oct 1st, 2005. |

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| **APEC ECONOMIES** | | | | |
| PEOPLE's REPUBLIC OF CHINA - Customs | Economy level | General Administration of Customs | GTIN Application for Import Goods Declaration" by the General Administration of Customs | The General Administration of Customs has included GTIN in the import declaration in the field of cross-border e-commerce and general trade, and launched the GTIN declaration function in the "single window" to improve the accuracy and efficiency of customs clearance. In 2022, the new version of the "People's Republic of China Customs Import and Export Commodity Declaration Catalogue" included product barcode (GTIN) as one of the mandatory element, involving more than 20 key categories (8-digit HS Code), including wheat-based food, infant food, biscuit, beer, cosmetics, wine & liquors, to achieve intelligent backfilling of product declaration elements, improve the accuracy and efficiency of customs clearance hence facilitate international trade. |
| PEOPLE's REPUBLIC OF CHINA - Customs | Economy level | General Administration of Customs | Announcement of the Regulation of Cross-border E-commerce Retail Import Commodity GTIN Declaration" by Customs in All Custom Districts. Links to some of the custom districts announcements:<br>- Announcement of the Beijing Customs No. 1 of 2023 (Beijing Customs Announcement on the Application of Barcodes for Commodities Imported by Cross-border E-commerce Retailers) http://beijing.customs.gov.cn/beijing_customs/434756/434804/2941702/bggg50/434770/4842706/index.html<br>- Shanghai Customs Announcement on the Application of Barcodes for Commodities Imported by Cross-border E-commerce Retailers http://beijing.customs.gov.cn/shanghai_customs/423405/qtzhxx1/423461/423462/4839951/index.html<br>- Announcement of the Chengdu Customs No. 1 of 2023 (Chengdu Customs Announcement on the Application of Barcodes for Commodities Imported by Cross-border E-commerce Retailers) http://chengdu.customs.gov.cn/chengdu_customs/519425/fdzdgknr1/bggg48/519408/4837319/index.html | In February 2023, the application of cross-border e-commerce retail import commodity GTIN was fully promoted and implemented in all People's Republic of China custom districts. For the first time, the General Administration of Customs nationwide customs districts issued the Notice on Standardizing the Declaration of GTIN for Cross-border E-commerce Retail Imports. Cross-border E-commerce enterprises should accurately fill in the "barcode" information on the list form in accordance with the reporting requirements of the "Specification of enterprise interface messaging in the unified cross-border system of customs (Trial)" (Announcement of the General Administration of Customs, PRC No. 113 of 2018). |
| PEOPLE's REPUBLIC OF CHINA - Ministry of Commence | Economy level | Ministry of Commerce | Special Action Plan for the High-Quality Development of Trade and Logistics (2021-2025) By the Ministry of Commerce. Link to the special action plan: https://www.gov.cn/zhengce/zhengceku/2021-08/10/content_5630532.htm | This action plan promotes the high-quality development of trade logistics, including the suggestion to apply GS1 standard, expand the information carrying function of standard pallets and turnover boxes (baskets), and promote the association and connection between pallet code (GRAI) and product barcode (GTIN), box codes (GS1-128) and shipping unit codes (SSCC). This action plan was published on Aug 6th, 2021. |
| HONG KONG, CHINA | Economy level | Import and Export Ordinance (Cap. 60) | Regulates cross-border trade, establishing requirements for the traceability of products that are imported or exported.<br><br>https://233773342789-lic.s3.eu-central-1.amazonaws.com/attachments/legislation/hong-kong-china/Import%20and%20Export%20General%20Regulations%20Cap%2060A_01.04.2017.pdf | |

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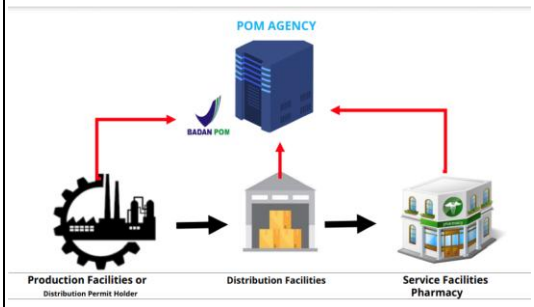
| INDONESIA - Indonesian Regulation regarding Traceability that using GS1 Standards | Economy level | BPOM regulation no.22 year 2022 | Application of 2D Barcode In Food And Drug Control<br><br>The ApplicationTrack and Trace BPOM is an application for issuing codes containing a series of numbers and letters in 2D Barcodeand/or record every product movement so that product and product location information can be obtained, both the current location and the history of the location of the movement of the unique product.<br><br>2D Barcode For drugs must contain at least the following information:<br>a. Distribution Authorization number and/or product identification number that is valid internationally;<br>b. batch number or production code;<br>c. expiration date; and<br>d. serialization number.<br><br>https://standar-otskk.pom.go.id/storage/uploads/8d4d0905-049d-401a-a77c-fa3f88d22025/PerBPOM-No.-22-tahun-2022.pdf |  <br>Figure 3. Implementation Flow*2D Barcode*-Authentication |
| INDONESIA - Ministry of Agriculture. Indonesian Regulation regarding Traceability that using GS1 Standards | Economy level | Guidelines on requirements and animal quarantine measures for the release of swallow's nest from the Republic of Indonesia to the People's Republic of China | Animal quarantine as one of the institutions that is part of the domestic animal health system, has an obligation to support the acceleration of the export of swallow's nests to various trading partner economies, by ensuring the health of swallow's nest animal products that are exported from the territory of the Republic of Indonesia free from Quarantine Animal Pests and Diseases (HPHK), free from other contamination as food ingredients that are safe for human consumption. If something happens that is not in accordance with the guarantee of food safety, then tracing of swallow's nests can be achieved using a traceability system.(traceability) in the form of an EAN-128 barcode. | Example of a barcode for a swallow's nest product with the following identities:<br><br>Indonesia Economy Code : 0899<br>Company Registration Number at GS1. : 702320<br>Product Type Code : 0017<br>Swallow House Registration Number : 005<br>IKPH Registration Number : 001<br>Year Month Date of Production (11) : July 13, 2012<br>Packaging Code (21) : 0008<br><br>It will be written under the Barcode: (01)089970232000017(91)005(92)001(11)120713(21)0008. The numbers in brackets are the GS1 code.<br><br>The example of the company barcode above will be printed as shown in the image below:<br><br>(01)089970232000017(91)005(92)001(11)120713(21)0008 |
| JAPAN | Economy level | Regulation for Pharmaceutical and Medical Devices identification | In Japan, the revised Pharmaceutical and Medical Devices Act came into effect on December 1, 2022, mandating GS1 barcode marking on the packaging of pharmaceuticals and medical devices to ensure traceability. Establishes the Regulatory framework for controlling pharmaceuticals, cosmetics, in-vitro diagnostic reagents, medical equipment, and regenerative and cellular therapy items on the Japanese market. | |

| Research the Standard Process Methodology using international standards for the digital exchange of Traceability and ESG Credentials | | | | |
|---|---|---|---|---|
| **Traceability, ESG Credentials Methodology and GDS – Global Data Standards Research** | | | | |
| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **APEC ECONOMIES** | | | | |
| REPUBLIC OF KOREA | Economy level | Food Traceability Regulation | Regulation that aims to offer a guideline for target foods to manage traceability described in following Acts: FOOD SANITATION ACT, HEALTH FUNCTIONAL FOODS ACT, SPECIAL ACT ON IMPORTED FOOD SAFETY CONTROL, LIVESTOCK PRODUCTS SANITARY CONTROL ACT. | Article 7 (Method of Assigning Food Traceability Number). In the case of products sold to final consumers, the registrant shall indicate the food traceability number. Appendix 5 (Standards for Assigning Food Traceability Number):<br>1. If you want to combine a Food Traceability Number by using a product barcode (GTIN), "the product barcode number (GTIN) + the number (expiration date or production date, or lot number) assigned by a producer or an importer for traceability management " performs Food Traceability Number,<br>2. For products that do not use a product barcode (GTIN), "the food traceability registration number assigned by the Minister of Food and Drug Safety + the number (expiration date or production date, or lot number) assigned by a producer or an importer for traceability management" performs Food Traceability Number. |
| NEW ZEALAND | Economy level | Animal Products Regulations 2000 | Regulates the production, processing and marketing of animal products in New Zealand. It requires traceability of meat and dairy products to meet biosecurity and export requirements.<br><br>https://www.legislation.govt.nz/regulation/public/2000/0207/latest/DLM9546.html | |
| PERU - Ministry of Economy and Finance (MEF) | Economy level | Compliance report for the service to prepare a proposal for the structure of the single catalogue of goods, services and works for Peruvian government purchases. February 2020. Ministry of Economy and Finance - MEF | Proposal for the structure of the single catalogue of goods, services and works, which allows for harmonization with the government budget classifier and the general accounts. General recommendations for its subsequent implementation up to the level of disaggregation that allows traceability throughout the supply chain. | Recommendation for the use of GDS – Global Data Standards for specific identification to develop the structure of the Single Catalogue of goods, services and works of the General Directorate of Supply – Ministry of Economy and Finance - MEF |
| PERU - Ministry of Economy and Finance (MEF) | Economy level | Consulting service for the identification and proposal of the prior actions required for the development and implementation of the Single Catalogue of Goods and Services. July - August 2020. General Directorate of Supply, Ministry of Economy and Finance - MEF | Implementation of the methodological route for the development and implementation of the Single Catalogue of Goods, Services and Works within the framework for Peruvian Domestic Supply System, establishing its strategy, timing, critical milestones and necessary conditions. | |

| Research the Standard Process Methodology using international standards for the digital exchange of Traceability and ESG Credentials | | | | |
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| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **APEC ECONOMIES** | | | | |
| PERU Peruvian Tax Agency (SUNAT) | Economy level | Superintendencia Resolution No. 309-2018/SUNAT | On December 30, 2018, SUNAT (Superintendencia Nacional de Administración Tributaria) published Resolution No. 309-2018/SUNAT, which, among other topics, extended until July 1, 2019, the requirement to include the SUNAT Product Code on invoices, sales receipts, credit notes and debit notes issued electronically by electronic issuers incorporated into the Taxpayer's Electronic Issuance System (SEE del Contribuyente) and the Electronic Issuance System for Electronic Service Operators (SEE - OSE). | SUNAT Product Code is a mandatory field on the aforementioned payment vouchers. This field must contain, for all types of operations, up to the third hierarchical level of the United Nations Standard Products and Services Code (UNSPSC). However, in accordance with the structure defined for invoices, sales receipts, credit notes and debit notes issued electronically, this field must contain 8 digits. It is also possible to use the GTIN (Global Trade Item Number) code instead of the SUNAT Product Code. For this purpose, the field related to the GTIN must contain 14 characters.<br><br>The UNSPSC code is an international codification that allows the classification, based on a hierarchical arrangement and a logical structure, of goods and services with similar characteristics, while the GTIN Code is a codification that is used worldwide to uniquely identify products, packaging and services in the logistics chain. |
| PERU - Ministry of Health | Economy level | Standard coding in the health sector. DS 024-2005-SA | Since 2005, the Ministry of Health issued Supreme Decree 024-2005-SA, which approves the standard identification of GS1 GTIN Code and other activities in favor of technological innovation in processes, organization and use of global standards that favor the supply chains of the health sector in Peru. | The document "Standard Identification of Health Data No. 002 - Pharmaceutical Product in the Health Sector" is approved, among others, in whose numeral 4.3.2. says: "4.3.2. The specific name of the pharmaceutical product established in numeral 4.3.1. will be assigned the corresponding EAN/UCC code (European Article Numbering or Uniform Code Council, which will be called the specific code of the pharmaceutical product". EAN/UCC is the past name of the actual GTIN Code. |
| THAILAND | Economy level | TAS 9028-2008 - Principle for Traceability/Product Tracing as a tool within an agricultural commodity and feed inspection and Certification System. Issued by National Bureau of Agricultural Commodity and Food Standards, Ministry of Agriculture and Cooperatives. | Article 3.2.2: The traceability/product tracing tool should be able to identify at any specified stage of the food chain (from production to distribution) from where the food came (one step back) and to where the food went (one step forward), as appropriate to the objectives of the agricultural commodities and food inspection and certification system. Displaying on food labels: (2) Meet international standards or equivalent on conformity and certified processing system, from raw materials through to the finished product, including traceability. | |

| Research the Standard Process Methodology using international standards for the digital exchange of Traceability and ESG Credentials | | | | |
|---|---|---|---|---|
| **Traceability, ESG Credentials Methodology and GDS – Global Data Standards Research** | | | | |
| **Organization** | **Global and Economy level** | **Document, Methodology, Guidelines Manual Name** | **Description** | **Detailed Information** |
| **OTHER ECONOMIES** | | | | |
| ARGENTINA | Economy level | Disposición 2303/2014 | The National Administration of Drugs, Food and Medical Technology –ANMAT and the Ministry of Health of the Presidency of the Nation - Argentina | Exclusive provision for Medical Device Traceability where the use of GTIN, Batch, expiration date and Serial is required, in addition to the GLN for entities. |
| ARGENTINA | Economy level | Disposición 3683/2011 Disposición 1831/2012 Disposición 963/2015 Disposición 7038/2015 | The National Administration of Drugs, Food and Medical Technology –ANMAT and the Ministry of Health of the Presidency of the Nation - Argentina : Traceability System for medicines that must be implemented by natural or legal persons involved in the marketing, distribution and dispensing chain of medicinal specialties included in the Registry of Medicinal Specialties | Patient safety is the great challenge of the health sector. Medical errors can be eliminated by creating ecosystems throughout the supply and value chain of the sector with intensive use of global standards and practices that allow visibility of the entire chain, reducing risks and allowing timely intervention before they occur.<br><br>The National Administration of Drugs, Food and Medical Technology –ANMAT and the Ministry of Health of the Presidency of the Nation - Argentina Since 2011, the GS1 has published a series of Official Provisions that are in force, which designate the companies and products that must comply with different rules, including the use of the GS1 standard for the identification of secondary drug packaging with GTIN, Batch, expiration date and Series. The use of GLNs is also required for the identification of legal and physical entities, as well as verification of Reading Quality. |
| BRASIL | Economy level | Brazilian Ministry of Finance | Requirements for registration and validation of GTIN by regulatory bodies. Electronic Invoice with GTIN. Links: https://gs1go2.azureedge.net/sites/gs1/files/case_study_library_item/Verified_by_GS1_CS_SEFAZ_Case_Study_2.pdf https://www.confaz.fazenda.gov.br/legislacao/ajustes/2019/ajuste-sinief-no-26-19-1 https://www.confaz.fazenda.gov.br/legislacao/ajustes/2019/ajuste-sinief-14-19 https://www.confaz.fazenda.gov.br/legislacao/ajustes/2019/ajuste-sinief-13-19 https://www.confaz.fazenda.gov.br/legislacao/ajustes/2019/ajuste-sinief-04-19 | Brazil's Ministry of Finance, through the NF-e (electronic invoicing) framework, has established that the Global Trade Item Number (GTIN) must be included and validated in electronic invoices when applicable. Under this regulation, the GTIN reported in the invoice (fields cEAN and cEANTrib) is automatically validated against the "Cadastro Centralizado de GTIN (CCG)", a centralized database maintained in coordination with GS1 Brazil. If the GTIN is missing, invalid or not properly registered, the invoice is rejected in real time, effectively making standardized product identification a mandatory and enforceable fiscal requirement in Brazil. |

## 9.2. Executive summary - APEC Project CTI 207 2023A MSMEs participant's Survey Report

During the implementation of the pilot projects in the three economies, a survey was conducted with the participating MSMEs to gather insights on their experience, including the benefits obtained, lessons learned and recommendations for improving future scaling or replication processes. A summary of the survey results is presented below.

### 9.2.1. Project:

Improving supply chain transparency through the digital exchange of traceability and ESG credentials to facilitate APEC trade.

### 9.2.2. Survey period:

29 April to 6 May 2025

### 9.2.3. Total respondents:

11 participants from 6 companies in People's Republic of China; Indonesia and Peru

| Economy | Production Chain | Female | Male | Total |
|---|---|---|---|---|
| People's Republic of China | Down Coats | | 1 | 1 |
| | Silk Products | | 1 | 1 |
| Indonesia | Coffee | 1 | | 1 |
| | Palm Sugar | 1 | | 1 |
| Peru | Coffee | 1 | 4 | 5 |
| | Wood | | 2 | 2 |
| Total | | 3 | 8 | 11 |

*Table 1 – Survey respondents. Source: Own Elaboration*

### 9.2.4. Survey Objective

To gather feedback on participants' experience with the pilot implementation focused on digital traceability and ESG (Environmental, Social, and Governance) credentials.

### 9.2.5. Key Findings

#### a. Implementation Experience

- 100% rated their experience as Excellent (54.5%) or Good (45.5%).
- 90.9% found the support provided to be adequate.
- 63.6% found it easy to integrate traceability and ESG records into their processes.
- Challenges: connectivity issues, initial unfamiliarity with the tool, delays in data collection.

- Barriers to scaling: limited resources, high data volume, time needed for operations.

**b. Visibility Platform**

- 91% experienced no technical difficulties.
- Suggestions: improve training, enhance offline features, simplify processes.

**c. Perceived Results**

- 81.8% observed increased transparency.
- 60% noted clear improvements in traceability.
- Benefits: reduced time and costs, improved visibility, enhanced marketing potential.
- Future steps: strengthen digital systems, adopt new technologies, reduce paper use.

#### 9.2.6. Conclusions

The pilot was positively received and significantly contributed to improving traceability and ESG credential management. Participants appreciated the clarity of objectives, the support received, and the platform's usefulness, identifying high potential for future adoption despite some operational limitations.

## 9.3. Global background and APEC references on Supply Chain Transparency, Traceability, Visibility and ESG Credentials

To strengthen the relevance, alignment, and practical value of this final report, we have carried out a comprehensive review of studies, reports, and implementation frameworks developed under APEC initiatives over the past 15 years. These documents address key areas closely related to the objectives of this project, including traceability, supply chain transparency and visibility, ESG (Environmental, Social, and Governance) credentials, sustainability, digitalization of MSMEs, and the use of Global Data Standards (GDS).

This review aims to highlight the most important findings, conclusions, and recommendations from past APEC efforts, allowing us to integrate and build upon existing knowledge. By identifying synergies with previous work, we seek to generate alignment between our results and broader regional priorities, while ensuring that lessons learned, and best practices already developed by APEC economies are reflected in our own conclusions. This approach reinforces continuity and coherence in APEC's collective efforts to enhance inclusive, sustainable, and transparent trade across the region.

| # | Publication Title | Year | Document's web link | Topic | Author | APEC Area | Key Content |
|---|---|---|---|---|---|---|---|
| 1 | GS1 Global Traceability Standard | 2017 | https://www.gs1.org/sites/default/files/docs/traceability/GS1_Global_Traceability_Standard_i2.pdf | Traceability, Transparency, Interoperability | GS1 Global | | GS1's framework for the design of interoperable traceability systems for supply chains |
| 2 | Study on the Application of GDS for APEC Supply Chain Connectivity – Phase 1 | 2017 | https://www.apec.org/docs/default-source/publications/2017/2/study-on-the-application-of-global-data-standards-for-apec-supply-chain-connectivity-phase-1/217_psu_170130-apec-gds-final.pdf | Global Data Standards, Traceability, Visibility | APEC PSU | CTI / PSU | Initial GDS pilot demonstrated interoperability and impact across selected supply chains, providing a technical baseline for future phases. |
| 3 | Study on the Application of GDS for APEC Supply Chain Connectivity – Phase 2 | 2017 | https://www.apec.org/docs/default-source/publications/2017/11/study-on-the-application-of-gds-for-supply-chain-connectivity---phase-2/217_psu_study-on-the-application-of-global-data-standards-for-supply-chain-connectivity-phase-2.pdf | Global Data Standards, Traceability, Visibility | APEC PSU | CTI / PSU | Follow-up work explored barriers and practical solutions in greater depth. Conclusion: there is a need for technical training and sector-specific tools. The supply chains of Durian in Malaysia, Tequila in Mexico and Asparagus in Peru were addressed. |
| 4 | APEC Guidelines and Best Practices for the Adoption of Global Data Standards (GDS) | 2020 | https://www.apec.org/docs/default-source/publications/2020/3/apec-guidelines-and-best-practices-for-the-adoption-of-global-data-standards/220_cti_apec-guidelines-and-best-practice-for-the-adoption-of-gds.pdf?sfvrsn=fb304fc6_1 | Global Data Standards, Traceability, Visibility | CTI / APEC PSU | CTI | Pilots conducted in 2017 validated that GDS improves efficiency, integrity, and visibility. It recommends clear steps for adoption and pilot planning. |
| 5 | GS1 Traceability Checklist Assessor's Guide | 2021 | https://www.gs1.org/docs/traceability/GS1_Traceability_Checklist_Assessors_Guide_V1.0.pdf | Traceability, Transparency, Interoperability | GS1 Global | | Definitions, Traceability Systems Capabilities, Enabling Technologies, Interoperability Requirements |

| # | Publication Title | Year | Document's web link | Topic | Author | APEC Area | Key Content |
|---|---|---|---|---|---|---|---|
| 6 | GS1 Global Traceability Compliance Criteria Standard | 2021 | https://www.gs1.org/docs/traceability/GS1_Global_Traceability_Criteria_CheckList_Standard.pdf | Traceability, Transparency, Interoperability | GS1 Global | | Describes the assessment criteria for full chain traceability, providing a single process of meeting regulatory & industrial requirements using the GS1 Standards |
| 7 | Measuring Progress on the Supply Chain Connectivity Framework (SCFAP III): Indicators and Policy Practices | 2023 | https://www.apec.org/docs/default-source/publications/2023/9/223_psu_scfap-iii.pdf?sfvrsn=9934578a_2 | Key Performance Indicators (KPIs), Connectivity, Visibility | APEC PSU | PSU | Identifies 69 indicators and highlights relevant policy practices. Serves as a key tool for future evaluation. |
| 8 | 2024 Annual Report to Ministers | 2024 | https://www.apec.org/docs/default-source/publications/2024/11/224_cti_annual-report-to-ministers.pdf?sfvrsn=d18d7f13_1 | Trade Facilitation, Connectivity, Digitalization, Innovation | APEC CTI | CTI | CTI 2024 work |
| 9 | APEC Supply Chain Connectivity Framework Action Plan (SCFAP III) 2022–2026: Mid-term Review | 2024 | https://www.apec.org/docs/default-source/publications/2024/11/224_psu_scfap-iii-mid-term-review.pdf?sfvrsn=d4fd796b_1 | Digitalization, Visibility, Connectivity | APEC PSU | PSU | Progress was made in 4 out of 5 chokepoints. Specific recommendations were provided by topic: digitalization, infrastructure, data flows, sustainability, and MSME support. Performance indicators were defined. |
| 10 | GS1 Trace Way | 2025 | https://www.gs1.org/standards/traceability/traceway/tool | Traceability, Transparency, Interoperability | GS1 Global | | Step by step approach to design and implement interoperable traceability systems in the supply chain. GS1TraceWay is an interactive methodology to help demystify traceability based upon a best-in-class process approach to initiate, assess, design and deploy traceability systems. |

### 9.4. Twelve (12) Questionnaire for companies' assessments

| No. | 12 Checkpoints |
|---|---|
| 1 | How do you identify the inputs and raw materials you receive and use in each part to the harvest, production, packaging and dispatch process? |
| 2 | How do you identify your locations? For example: harvest plots, processing areas plant, warehouse, etc. |
| 3 | How do you identify the final products produced, at the primary, secondary packaging and pallet level? |
| 4 | Do you have a Master Data with information for raw materials, finished products, suppliers, transporters, customers and staff, among others? |
| 5 | What are your processes from harvesting or receiving raw materials to the dispatch of your finished products? Identify Critical Tracking/Monitoring Events (CTEs) |
| 6 | What information/records/registries do you consider in the processes from harvesting or receiving raw materials to the dispatch of your finished products? Also include Environmental, Social and Governance (ESG) information. Identify within each Critical Tracking/Monitoring Events, all the Key Data Elements (KDEs) to guarantee traceability, risk management and ESG registries and credentials |
| 7 | How do you record/registry reception, production and dispatch processes information? |
| 8 | Do you have a document containing batch definitions, processes, scope, objective of the traceability system and personnel responsible for recording/registering the information? |
| 9 | How do you search for information about a non-conforming product or claim? |
| 10 | Who is responsible for entering information and records of the receiving, production and dispatch processes? |
| 11 | Do you train your staff in terms of traceability processes? How do you train your staff? |
| 12 | What controls/measurements do you have to monitor your processes? |

## 10. GLOSSARY AND ABBREVIATIONS

| | |
|---|---|
| 2D Digital Link | GS1 2D Digital Link is a next-generation barcode that enables products to connect to online content via smartphones and other devices. It links product information such as descriptions, expiration dates and traceability details to a digital platform, enhancing supply chain transparency and consumer engagement. |
| APEC | Asia-Pacific Economic Cooperation |
| APPAGROPS | Asociación de Pequeños Productores Agropecuarios, in english: Association of Small-Scale Agricultural Producers |
| ESG | Environmental, Social and Governance |
| FSC | Forest Stewardship Council<br>An international non-profit organization that promotes responsible management of the world's forests. FSC certification ensures that forest-based products come from sustainably and ethically managed sources. |
| GDS | Global Data Standards |
| GLN | Global Location Number identifies the location of the event and the stakeholder involved. |
| GRP | Global Registry Platform is a global platform that enables the reliable and standardized exchange of product master data among supply chain partners, using GS1 standards. It functions as a central registry that validates and links key product data (such as GTIN, name, brand, dimensions, etc.) with their authorized owners, ensuring that shared information is accurate and up to date. This platform enhances interoperability across systems and countries, facilitates traceability, reduces errors in commercial transactions, and optimizes product management efficiency at a global level. |
| GS1 | GS1 Global (Global Standards One) is a non-profit international organization that develops and maintains open, global standards for business communication, most notably the barcode system. It helps companies enhance supply chain efficiency and transparency through standardized identification and data exchange systems used across industries worldwide. |
| GS1-128 | Barcode standard based on the Code 128 symbology that allows businesses to encode complex information like batch numbers, expiration dates, and serial numbers. It is called GS1-128 because it follows the GS1 standard and uses Application Identifiers (AIs) to define the meaning of the data. While the name refers to Code 128, there are actually more than 128 Application Identifiers available for companies to represent different types of information. |
| GTIN | Global Trade Item Number is a GS1 identification key used to globally identify tradeable items |
| HACCP | Hazard Analysis and Critical Control Points. A systematic preventive approach to food safety that identifies, evaluates, and controls significant hazards throughout the food production process. It is widely used to ensure the safety of food products in compliance with international standards. |
| MSME | Micro, Small and Medium Enterprise |
| OEM | Original Equipment Manufacturer, is a company that produces components or finished products for other companies, which then sell them under their own brand |
| SERFOR | National Forest and Wildlife Service (SERFOR). Peruvian authority responsible for establishing policies and regulations, as well as overseeing, supervising, and promoting the sustainable management, conservation, and protection of wildlife flora and fauna. |

| | |
|---|---|
| SNIFFS | SERFOR's Forest and Wildlife Information System. An official digital platform to register, monitor and control forest and wildlife resources. Supports traceability of timber and related products by documenting their origin, transport and commercialization, ensuring compliance with domestic regulations and international commitments on sustainable forest management and trade. |
| SSCC | Serial Shipping Container Code. A globally unique identifier used to track logistics units (such as pallets, cases, or containers) across the supply chain. It enables accurate management, visibility and traceability during transport and storage by linking each unit to detailed electronic information. The SSCC ensures that all parties in the supply chain can reference the same logistics unit consistently, supporting efficiency, interoperability and error reduction. |
| WMS | Warehouse Management System |